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ABSTRACT

A selected collection of architectural programming techniques has been assembled to aid architects in building design. Several exciting and sophisticated techniques for determining a basis for environmental design have been developed in recent years. These extend to the logic of environmental design and lead to more appropriate and useful facilities. The significant areas of concern with architectural programing are communications, problem definition and hierarchy, fact collection, fees and services, research, testing, and evaluation. Case studies and examples of techniques indicated possible uses of architectural programing for planning and design. (TC)

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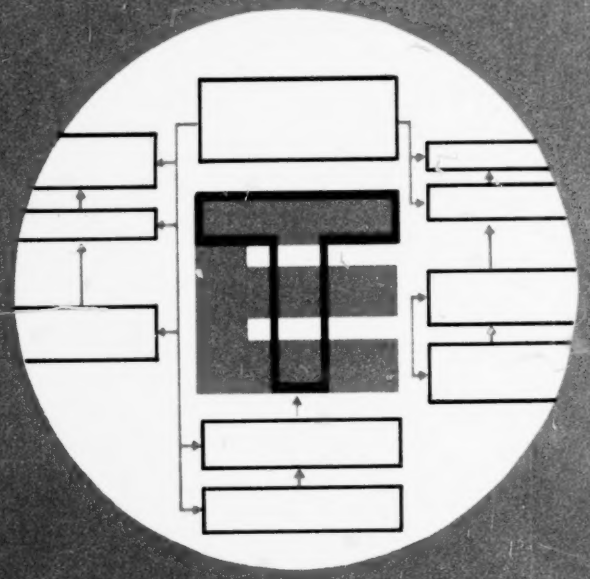
THE AMERICAN INSTITUTE OF ARCHITECTS

EMERGING TECHNIQUES · 2

ARCHITECTURAL PROGRAMMING



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Emerging Techniques · 2

Architectural Programming

Emerging Techniques of Architectural Practice — a continuing study by the Committee on Research for Architects

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Foreword

The AIA report, "Emerging Techniques of Architectural Practice," by Professor C. Herbert Wheeler, Jr., AIA, delineated many new practices in the architectural profession which appear to have significant effect on future practices. One of the areas thought to have a most critical need and also to have great potential was that of architectural programming.

As part of the continuing study of "emerging techniques" of architectural practice, the Committee on Research for Architecture of The American Institute of Architects felt that the area of programming needed investigation and directed that this study be undertaken. Recognizing that within the limited time, budget, and manpower available, a thorough and detailed study of "how-to program" could not be completed, the Committee decided that a collection of programming techniques would be useful as an aid to all practitioners who are continually trying to improve the quality of their own services.

The Committee wishes to express its appreciation to the many architectural and consulting firms which contributed their time and energy in helping to gather this information, to C. Herbert Wheeler, Jr., AIA, for his continuing interest, assistance, and inspiration for collection of information on techniques (chapter 4); and Benjamin H. Evans, AIA, on whom the prime responsibility rested.

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PART 1

CHAPTER 1

INTRODUCTION

In the past, architects have almost always dealt with historical building types. They knew somewhat intuitively which physical environment would suffice to meet the already well established patterns of activity of society. A bank was a bank, and a school, a school. Everyone knew what would take place in these institutions. A thorough and lengthy analysis of the institutional operation was not necessary prior to design. As society and technology changed and became more complicated, architects and owners had to look for new ways to determine the basis for environmental design.

Some exciting and sophisticated techniques for determining this basis have been developed in recent years which extend to the logic of environmental design and which lead to more appropriate and useful facilities. However, there is still much to be done in the development of methods for analysis and in getting these methods into general use.

Owners and clients frequently are reluctant to finance a thorough analysis of their needs because of a lack of understanding as to the value of such studies and because people are still able to adopt many old buildings and spaces to fit new needs. That they are so frequently able to do so somewhat conceals the fact that too often old buildings, still structurally sound, are being razed because they have outlived their functional and economic usefulness and cannot be adapted. People frequently do not recognize that this is often a result of the lack of farsighted planning.

It is not yet possible to plan and design facilities which can always, without fault, effectively and efficiently respond to changing needs and new societal patterns, but there is no doubt that planning and study techniques can be developed which will be more effective. Generally speaking, better planning processes, or architectural programming techniques, will result in environmental spaces which are better suited to future needs and less prone to financial or functional obsolescence. The process for doing this is commonly referred to as *Architectural Programming*.

Definition

Architectural programming in this context is defined as the process by which criteria are developed for the design of a space, building, facility, physical environment, and/or any unit of the environment. The term programming in its generic sense can be applied to any planning of future procedures, but in this report it is used only as it applies to architecture. It is the means through which data about the needs of the ultimate building user are determined and expressed for the instruction of the architect in the development of a design solution.

A statement of such criteria will include all of the characteristics or functional requirements expected of a given activity to be housed, and many include social, spiritual, esthetic, or esoteric considerations that may or should influence the decision making. The architectural program usually will be stated in written form, but the written form itself is not the program; it is a statement of the program at some particular point in time. A program is not a definitive object. It is a *process* which seldom, if ever, reaches an ideal state, and the process usually continues through planning and design as new ideas are formulated and new hypotheses are derived.

There is often confusion among different disciplines about the term programming, and, indeed, this difference of definition or interpretation frequently leads to serious problems. Educators, for example, often refer to the development of space requirements as "educational specifications," whereas the architect considers this programming.

Elements of Programming

Terminology is, of course, important only insofar as it is a vital factor in communications. What is more important for this discussion is an understanding of the range of elements included in an architectural program so that all concerned parties can communicate. There are four general parts of the programming process:

- CLIENT PHILOSOPHY AND OBJECTIVES
  Establish the client's goals, attitudes, aspirations, characteristics, etc.
- FUNCTIONAL RELATIONSHIPS
  Relationships between administration, departments, services, equipment, processes, community, public, etc.

- FACILITY SPACE REQUIREMENTS
  Development of requirements based on activity programs, equipment needs, traffic movement, personnel projections, etc.

- CLIENT BACKGROUND AND RESEARCH
  Studies to determine community characteristics, economic base, industrial potential, labor market, population distribution, growth projections, etc.

The development of a program statement covering these items is the responsibility of the client. Naturally, the client may assign this responsibility to an outsider, but his own organization must take an active role in the development of the program if that program is to accurately and effectively reflect the needs and desires of the client. Sometimes the client thinks that the task can be delegated to someone else, possibly the architect, so that the client does not need to be involved. Nothing could be less productive.

It is necessary, however, that the architect be involved in the programming process from the very beginning so that he can assist the client in thinking creatively about his program and so that he, the architect, can stay well informed of the reasons behind programming decisions. A strong client-architect relationship is invaluable in the development of a good program and the ultimate facility.

After the collection and analysis of data on the four elements of programming, the architect then can develop his program instrument from which the designs are produced. This instrument generally includes the following:

- specific facility requirements
- site development requirements
- characteristics of the occupants
- characteristics of the site
- objectives of the master plan
- relative location and inter-relationship of spaces
- functional requirements for the facility
- flexibility needs for future growth and changes
- priority of need among requirements
- special restrictions and limitations
- budget

There certainly are differences of opinion as to what specific elements are normally included in programming. Master planning — the planning of broad elements that usually proceeds the planning of a specific facility — is definitely an important input for programming, but it generally is done separately from what is commonly called programming for a specific facility. Some architects consider that the collection of facts pertaining to site, utilities, and so forth, is not part of the program — that the program deals with concepts. Feasibility studies, financial analyses, and site analyses are likewise sometimes considered part of programming and other times considered separate. The fact that different people use the term architectural programming to mean different concepts is, of course, confusing. However, as long as client and architect alike realize the problem, they can take care to be sure they are talking about the same subject.

Values

The values of good architectural programming are manyfold. The process clarifies the intentions of owner, user, and designer before planning is begun. It reduces the necessity for changes during final design, development of construction documents, and construction. It provides a basis for arbitration should differences of opinion occur. It reduces the chances for wasted space, excessive equipment, and poor relationships between parts.

John Summerson wrote in the Royal Institute of British Architects *Journal*, "The programme [sic] as the source of unity is, so far as I can see, the one new principle involved in modern architecture." In short, the development of thorough programming procedures holds promise of being the most significant development in architecture in current times.

Programmers

Often programming has been done by whoever happens to be available at the appropriate moment and not always by those who were best equipped by education and training. The results have clearly demonstrated the need for talent in this very important process. Architects and clients, as well as others, have and are developing their capabilities for doing programming. There appears to be developing what might be considered a new speciality — that of dealing with the architectural program. Architectural firms are find-

ing that objective, quality programs are best accomplished when a person with the proper experience and knowledge handles the investigations. Contemporary environment is so complicated, and becoming more so every day, that the intuitive processes are often no longer adequate for programming. Today's programmers must be especially qualified to conduct analytical, objective, unbiased, logical, and creative studies of the user's needs.

There are many programming experts active in the field today. A number of them have found it profitable to operate as independent consultants, often working for both architectural firms and clients. Because of the competence of these programmers, some architectural firms have found their work most helpful. Unfortunately though, there are some so-called programming specialists whose work has not been beneficial to the architects.

Other programmers who have developed competency have gone to work for universities, government agencies, industrial organizations, and other large clients. These people are having a significant influence on the nature of the physical environment of their institutions as they are developed. Sometimes the architects, who are the recipients of the results of the efforts of these programmers, judge their work to have been quite useful. Other times their work is considered restrictive and uncreative.

The basic premise of consulting programmers seems to be that the programmer must be in a completely impartial position — that he must be someone who has no prejudices, who is completely unbiased in his approach to the study. Consultants argue that they are in a better position to meet these requirements than architects. Architects, on the other hand, argue that programming cannot be done effectively without simultaneously considering design. Perhaps the important point is that programming should be done by capable persons regardless of organizational position or educational background.

It is logical that persons talented in one area will be more efficient at that job than at some task which does not require the full range of their talents. Thus, designers who are called upon to do programming frequently are not used efficiently, particularly when there are those around who are well prepared to do the job. Collecting routine information is a waste of design talent and often the wrong investigator will overlook significant factors.

There are elements of programming for which the architect is not traditionally educated, such as the investigation of the potential market for a certain type of commercial enterprise. However, architects can, and often do, employ experts for such jobs just as most programming consulting firms would have to do. One might conclude that talent is where you find it and that "title" is not as important as capability.

Because the significance of good programming is being recognized more than ever, architectural firms are concentrating on developing greater capabilities in this area. Architects are assuming a greater leadership role in the programming process and the results of their increased preparedness are reflected in increasingly better environmental facilities.

CHAPTER 2

SIGNIFICANT AREAS OF CONCERN

The study reported herein includes discussions with a selected group of people from throughout the country. It is not an attempt to determine all activities in programming or to report an "average" condition. Rather it is an attempt to seek out those who were reported as doing something unusual. Whether or not those interviewed were, indeed, doing something unusual depends on the reader's experience and viewpoint. Some will find many of the conditions reported foreign to their own experience. Some will find new ideas which they will put to work in their own practice. Some will find many of the activities described as ordinary. The following, however, reflects that which appears to be common among those interviewed.

Communications

The most common concern seems to be with the difficulty of communications. There is first of all difficulty over the interpretation of the word "program." Architects, clients, users, and programmers are constantly misunderstanding each other's intentions because each tends to attach a different meaning to the term. There is also the problem of getting at the client's or user's real desires — of

getting the client to think through and clearly express his needs. There is the problem of the client's understanding what services he can expect from his architects and consultants — of understanding what the architects' capabilities and motivations are — of understanding why the architect wants to discuss and incorporate certain esthetic or subjective elements, whose value cannot be clearly or definitely stated. There is the problem of the programmer clearly communicating his findings to the designer. There is the problem of the architect communicating his design decisions to the client in order that the client may clearly understand what his finished facility will be like and how it will satisfy his needs.

Unless the elements of communication are resolved, problems will arise, the job of planning and design will be more difficult and less effective, and the architect's profit will probably diminish. Too many professionals fail to recognize the importance of a greater emphasis on communication.

Problem Definition and Hierarchy

Despite the traditional notion that architecture has always been a problem-solving process, there is a growing recognition that many environmental facilities do not function appropriately because of the inherent difficulty in determining what the real problems or issues are prior to design. In any design effort, there are usually many problems to be solved, some of major dimensions and some very secondary. Too often it is difficult to determine which of the problems is most important and therefore most likely to have a major influence on the final form of facility.

Quite often a client states what he feels are the most pressing problems only to find later in the planning process that these were not the real issues. Failure to detect the essence of the problem at an early stage leads to wasted expenditures of energy, time, and finances and sometimes results in a confusing and inefficient design.

Architects are most often criticized for what is left out of a facility rather than what is included. This is because the average person, and indeed client, has little comprehension of the hierarchy of elements which must be established in the design stage.

It is extremely difficult for a designer to develop a hierarchy of design items that presents the total range of problems in such a way as to permit easy evaluation. It is difficult, for instance, to decide whether a particular, very efficient circulation arrangement will be more valuable than another which allows greater esthetic, and hence, human responses. Again, it is important that the programming process attempt to deal in some way with this hierarchy of problems in order that the client and architect can arrive at sensible decisions which ultimately will fit within the budget.

Fact Collection

The collection of facts pertinent to the design of a new facility would seem at first glance to be a simple problem. It frequently is anything but simple. Of course, anyone can collect information, but the problem is to collect the right facts, and to present them in a sensible order. Extraneous data only tends to confuse the issues. It has been said that the cost of compiling trivia is high and that the cost of analyzing it is even higher.

Some programmers seem to approach information gathering in a rather casual way. They just try to uncover the client's needs by asking the right questions. This essentially intuitive process has produced some notable programs simply because the people doing the programming were extremely capable, and perhaps because the building type, was reasonably simple. But, for most programmers a more systematic approach would seem to be necessary. Many firms, both architectural and other, are developing sets of schedules, questionnaires, and forms for use in data collection that will help them to avoid overlooking important items. Once the forms are complete, they can be reviewed, approved, and signed by the owner helping to clarify those elements considered essential.

On the other hand, there are those who argue that questionnaires and forms tend to limit and restrict the inquisitiveness of the programmer so that he may overlook something of importance simply because it has not appeared in a previous job. Under these conditions, programs may become stereotyped. Most people will agree that while questionnaires and forms may be very valuable as a checklist and evaluative tool, they cannot compensate entirely for a creative attitude on the part of the data collector.

In the past, architects particularly have felt that extensive knowledge about the functions of any specific building type was not necessary. The traditional attitude has been that a good designer can learn what he needs to know about a given set of problems by fairly elementary observations and study. There have been differences of opinion about this for sometime even within the architec-

tural profession. A team which has designed many schools, for instance, may feel that they have a much better grasp of the situation than the novice. On the other hand, the uninitiated feel that they can be more creative — that they are not restricted by preconceived ideas developed on the last such job.

There seems little doubt, however, that the current and future complexities of functions that must be housed, coupled with increasingly complex equipment and construction techniques, will more and more require an orderly and analytic programming process. The intuitive procedure, without the use of systematic tools, is not going to produce the necessary results.

The development of the systematic process seems likely to require the guidance of specialists. Indeed, there is already developing a sizable body of professionals which is devoting its entire effort toward developing competence in programming and even in special building types. While a background in architecture seems to be considered one of the most valuable ingredients, some knowledge of business and management also appears to be very useful.

Fees and Services

Perhaps the most frustrating problem connected with programming is the matter of responsibility and compensation. About the only "standard" there is for establishing the responsibility and determining the architect's compensation for programming is the AIA Document B131, "Standard Form of Agreement Between Owner and Architect." This document contains the following paragraphs:

ARCHITECT'S SERVICES

Schematic Design Phase

1.1.1 The Architect shall consult with the Owner to ascertain the requirements of the project and shall confirm such requirements to the Owner.

1.3 ADDITIONAL SERVICES

The following services are not covered in Paragraphs 1.1 or 1.2. If any of these Additional Services are authorized by the Owner, they shall be paid for by the Owner as hereinbefore provided.

1.3.1 Providing special analyses of the Owner's needs, and programming the requirements of the Project.

1.3.2 Providing financial feasibility or other special studies.

1.3.3 Providing planning surveys, site evaluations, or comparative studies of prospective sites.

1.3.4 Making measured drawings of existing construction when required for planning additions or alterations thereto.

These statements indicate that providing full information on the programming is the responsibility of the client, although the client may employ his architect to undertake the job of programming for an additional fee. Unfortunately, the document does not clearly define which of the various elements of programming are to be considered as part of the architect's basic services. Hence, there is room for interpretation and misunderstanding. In order to avoid this and any possible subsequent arguments, many architects choose to handle the programming themselves within their basic services and fees, compensating for the additional cost by establishing an adequate base fee in the beginning.

Some architects believe that there should be no question about the program being done by the architect and within his base fee. They contend that this is the best way to collect the proper data and to arrive at the best decisions in the client's interest.

Some architects maintain that separating programming from the architect's other responsibilities implies that there are some services which are necessary and some which are not, and that the owner can take his choice. Such practices tend to give an image of the profession as selling services in "little packages."

Perhaps the most significant problem produced by assuming that programming is part of the architect's basic services is that in the development of some building types the programming is quite significant and requires a considerable expenditure of time and energy. Unless the architect's fee is increased, and many times it is not, the firm will lose money or at least fail to make a profit on that job. On the other hand, some building types are so simple that very little programming is required and the architect easily can absorb the cost within his base fee.

Architects sometimes do programming for a job at their own cost, knowing that it will reduce or eliminate their profit, simply because they feel a responsibility to produce a good facility. The reputation of the firm is at stake if they attempt to design on the basis of a faulty program.

Doing the programming for the client free of charge indicates a dedication to good design, but it also says something about the lack of good business practices. The 1968 AIA study on the "Cost of Architectural Service" proves the point. There are many indications that the architect is not properly or efficiently charging for, or even recording, the service he renders. Such inconsistent practices as those involved in programming tend to confuse the client's image of the architect and consequently stimulate the growth of consulting programmers who work outside the architectural practice.

The "Cost of Architectural Services" survey reveals several statistics which are relevant to this discussion of fees and services:

1 On jobs contracted with private, individual clients, only one out of five clients provided a written program. In 50% of the cases, the architect rated the programs of poor quality. On those jobs for which the programming was done by the architect, the average additional income for programming was reported to be about $800 per job.
2 Institutional or corporate clients provided programs on one out of two jobs, and the architects rated 60% of these as good. On jobs where programming was done by the architect, the average additional income was about $4,000 per job.
3 For Federal and State government clients, the survey indicates that programs are provided on five out of six jobs and 66% are rated as good. For the programming done by the architect, the average estimated additional income was $3,200 per job.
4 For local government clients, three out of seven projects included programs from the clients, 60% of which were rated good by the architects.

Research Testing and Evaluation

While programming includes a great deal of fact gathering, it also inevitably includes some prognostications or downright guesses about what kind of facility will be required or even what function will be housed in the future. Such predictions are based primarily upon past experiences. Designers may know from previous experience that a particular room pattern will work under certain circumstances. They know that certain other plans will not work.

The experience, however, usually comes primarily by chance. Sometimes a previous client or user will complain about some facet of a facility that does not work properly. When the architect is called upon to explain why something does not work, he begins to build up an accumulation of knowledge of things that do and do not work. However, there seems to be a growing tendency for architects to systematically study their finished products to determine whether the original decisions, or programs, are performing as expected.

A truly thorough evaluation of a program and design is, indeed, quite complicated in most cases and, although architects and owners are reluctant to finance such studies, the need for them is growing constantly because of the increasing complexity of functions and equipment. There have been many attempts over the past few years to develop standard procedures by which building design can be evaluated, but, by and large, very little systematic post-construction study takes place.

Probably the more significant area of activity in research is where user functions are observed, manipulated, and studied in order to establish clear relationships between what is currently done in practice and what can be done with better planning. Such studies are particularly popular at the present in the public health facilities sector, principally because funding is more available and because the people concerned with health facilities are especially worried about the increasing rate of obsolescence.

There is activity also in the area of simulation studies. Several prominent researchers, psychologists, and architects are looking for methods by which designs can be simulated and evaluated while still in the planning stages. There are techniques being studied through which observers can be exposed to a simulated environment. There are also techniques being developed for making observations (a technique of simulation) inside a scale model through the use of special optical arrangements somewhat on the principle of the periscope. There are studies in progress to find ways and means by which the computer can be used to pre-test special arrangements and movement patterns. The computer is even being used, with the aid of an oscilloscope, to visually present a moving image of a proposed design.

Such research and simulation techniques undoubtedly will prove

extremely useful to architects in the future, but there will still be the need for careful and systematic evaluation of full-sized facilities in order to build a store of recorded experience and knowledge. Architects should not avoid their responsibility to prove to themselves and to their clients that their designs either work or fail to work the way they were planned. Such data is essential to continued progress.

CHAPTER 3

Case Studies

While the specific programming techniques described in the preceding chapter may be very useful tools, if taken out of context their use could prove ineffectual. It is therefore appropriate that there be some discussion of the organizational procedures used by various firms so that programming can be seen in its appropriate position as a part of a total effort. The following case studies are presented as interesting examples of procedure. The techniques used may be effective for one organization and not for another, but the descriptions are presented in the hope that they will provide useful insights.

Case Study 1: ARCHITECTURAL FIRM

It is true, of course, that a large firm can do certain things that a smaller firm cannot do simply because it is large and has a wide variety of available resources. However, a careful analysis of one large firm's procedures provides some helpful hints that may be useful even for smaller firms. The particular procedures herein outlined are from a large southwest firm (150 employees).

This relatively new firm, established since World War II, recently decided to delegate the programming responsibility for the firm to a special section directed by one of the senior partners. The section is concerned with three principal phases of activity: 1) to do research and collect information for use by the project managers and designers; 2) to establish analytical programming techniques and teach the project managers and designers how to use them, and 3) to provide service to clients in the development of program statements.

Why a separate section for programming? The firm believes that good designers and project managers are not necessarily good programmers. Designers sometimes try to get the client into a corner — to get him to commit himself to a preconceived idea or a concept formulated on insufficient data. Later the client may realize that he agreed to something with which he is not really satisfied, and a lot of costly redesign work may be necessary or he may always secretly resent the results of the project. The firm believes that someday the programming section may work itself out of a job when all of their project managers are fully prepared to accept and handle their own programming efforts.

Objectivity

Programming must begin with a collection of factual data. The collecting must be done systematically and objectively. The facts must not be clouded with opinions or prejudices. This firm does not mind throwing data away, but it wants the data exposed for inspection. They put down everything that can be put on paper, which emphasizes the importance of objective data collection. This documentation is believed necessary for communication.

Objectivity, however, has to be tempered with creativity at some point. This firm believes that the analytical approach is necessary and correct, but that objectivity alone frequently will fail to uncover significant possibilities unless creative inquisitiveness is there also. This is the reason why they believe strongly that good architects are the most logical people to do the programming.

Practice Philosophy

There are three major beliefs that govern this firm's approach. These beliefs have a significant bearing on their programming efforts. First, the firm believes in what they call the "Problem-solving approach." They believe that architecture, to a great degree, is a process of solving a series of problems, and that unless you know what the problems are you will never have a good piece of architecture. Secondly, they believe in the team concept. They believe

that solving problems today can best be done by a team of people with a variety of talents. They believe that the demands of modern society can best be met through the efforts of a coordinated and creative team. Thirdly, the firm believes in what they call their "squatters technique." This is a process by which the firm sends a team of designers to the site of a new project for the development of preliminary designs. It provides opportunity for bringing the client into the operation almost as part of the design team, and it allows the designers to become familiar with the peculiarities of the local situation. The use of the "squatters technique" is an unique characteristic of this firm which they believe pays off in better design and better client communications.

Another part of this firm's philosophy is that program, cost, and site go together as the elements that give form to a project. These are the big "form-givers" and must be considered together as well as individually. The firm looks at the program in terms of initial budget, operating costs, and long term costs. The three elements combined provide the real essence of the problem to be solved.

General Goals

A listing of the goals of this architectural firm will help to understand their approach.

- To identify and understand the problems. With the problem-solving approach to design, programming is problem defining.
- To provide a sound basis for responsible design. "Responsible" is used here to mean responding to the architectural program. It is difficult to respond to a vague or faulty program and still come up with a reliable design.
- To find the uniqueness of a project. Design solutions may take several forms because each project involves a different program, a different site, and a different cost budget.
- To boil down the architectural program to its essence. A program can be very complex, so it is necessary to seek out a manageable number of essential elements.
- To discriminate between the important form-givers and the less important details. While the flow of detailed information must not be stopped, constant effort must be made to delineate the most pertinent factors. The process may take two steps: the first step seeks form-givers for the conceptual design; the second step provides the details for design development. By that time, the flood of details will not obscure that which really is important in planning.
- To establish design objectives. The identification of major goals and big problems provides a direction for design.
- To uncover sources for inspiration. While a mere listing of space requirements is no source for inspiration, every project has the potential ingredients in the program, land, and cost to stir the imagination.
- To establish the limitations and explore the possibilities. Establish the realities of a project and, where there is leeway, explore for alternatives.
- To discover the real meaning of facts. The collection of facts is easy enough, but facts must be organized and analyzed to be useful.
- To uncover and develop strong concepts. The trick is to recognize a concept when one is in the offing.
- To establish the functional requirements. This is, perhaps, the most obvious goal, but programming must probe beyond function.
- To determine the legal, physical, and sociological influences. Every site is replete with form-giving characteristics. The legal and physical may be obvious. The sociological ones, such as tradition, ecology, and respect of neighbors, are more subtle.
- To determine the difference between wants and needs. Wants refer to preconceived solutions or desires not founded on the basic problems. Needs refer to the realistic requirements of space to meet functions, which recognize limitations of budget.
- To initiate cost control. Agreement must be reached on a realistic initial budget at this time. An optimistic budget can result only in a disappointing bid letting.
- To establish communication among the team members. Team members in action do not have time to read. Every item of information should be documented graphically for quick reference.

Procedure

This firm uses a five-step process in programming:

1 establish the client's aims,
2 collect, organize, and analyze data,
3 uncover and develop concepts,
4 establish needs, and
5 develop the problem statement or brief.

A number of techniques is used in the programming process including the use of forms to be completed by the client, as in the case of a college or university facility. The forms and Explanation of Forms Sheet following indicate the range of use of this technique. Other forms are developed for specific projects as the need arises.

Communication

This firm says, however, that one of their biggest problems in programming is communicating with the client. Hence, they place a great deal of emphasis on keeping the client "tuned in" to the project. This is done by a constant effort at keeping the client up to date on what is happening. A lot of this firm's effort is through the use of visual aids. For instance, they *"speak to the client"* with analysis cards and with brown paper analysis sheets. The 5x7 inch analysis cards are used for describing each of the many points on which the client should be informed — one idea to each card for emphasis. The cards may deal with several specific points about the site which will influence the design, or they may relate relevant climatic data, or code and zone restrictions. The important point is that the client looks thoroughly and systematically at the factors which will influence the design of his facility and understands why they are significant.

On brown paper work sheets, the firm illustrates for the client relative space quantities in block form and in square footage. During a work session these sheets can be pinned on the wall for the client's review. As changes are suggested, new brown paper sheets are pasted over the old ones until a satisfactory space allocation is produced. By the time the study is complete, these brown paper presentations have become quite thick.

Computers

The firm also is beginning to use its inhouse computer as a programming tool by collecting and analyzing data. The computer helps to record and recall many past experiences on space use, site analysis, and cost data. It helps in studying student enrollments, existing space uses, and frequency of use. While the use of the computer is still in a developmental stage, in the field of programming, it shows great promise for the future.

Case Study 2: PROGRAMMING FIRM

There are a growing number of firms throughout the country which specialize in building programming. Among them is a relatively large firm in New York City, which has a staff of professionals from a variety of background disciplines including industrial design, architecture, management, and economics. Their principal business is programming for *corporate, institutional,* and *governmental* clients.

The function of the firm is "to bring to bear a sum of experience in advanced researching techniques that relate to the human occupancy of space, by a space expert who is an informed, analytical researchist, with a thorough knowledge of design possibilities and limitations. This space analyst evaluates all pertinent facts and figures as to their relative worth, collates them into precise needs, and integrates them into a firm, coherent, and meaningful program statement with an incontrovertible basis in fact."

The firm states their goals clearly and quite specifically:

- create optimum working environment,
- organize work and traffic flow,
- establish effective communications,
- achieve maximum space utilization,
- foster good personnel relations, and
- provide for orderly growth.

The approach of this firm is thoroughly professional. They have nothing to sell but services, and their principle objective is to provide a useful service to their client. They see this professionalism as providing them with the basis for an objective and unprejudiced effort, even exceeding in this area the architect's traditional position of unbiased advisor. They believe that they are in a better position to do programming than the architect.

However, they prefer to work with architects on a job and do not presume to usurp, not even in part, the central and irreplaceable role of the architect as creator. They see their work as providing a good foundation on which the architect can perform his design services. Their jobs include many of the largest building

complexes in the country and they number among their clients some of the nation's largest and best known architectural firms.

The approach of this firm, to the achievement of the goals stated above, is through the following steps:

- confer with key personnel,
- review organizational data,
- develop personnel projections,
- analyze personnel traffic,
- review adjacency requirements,
- establish work flow patterns,
- inspect presently occupied space,
- analyze individual work stations,
- determine furniture and equipment needs,
- develop work space standards,
- establish conference requirements, and
- determine shared facilities.

In the realization of these steps, a series of questionnaires is used in face-to-face interviews with all key personnel involved in the client's activities. These questionnaires cover such matters as personnel strength, expansion requirements, visitor traffic, adjacency requirements, and other space utilization factors affecting space requirements.

The completed questionnaires usually are reviewed by the client's top management and a controlled technique used to assure uniformity of treatment in the processing of data and determination of space requirements.

Also, space occupancy "standards" are established for each functional work space based upon a careful study of individual job activities and responsibilities. These unit standards then can be applied to the number of work spaces required where uniformity of treatment is desirable — as a result, like functions receive like space. Special areas, such as laboratories and computer facilities, are not covered by these standards and are developed by individual studies.

TECHNIQUES

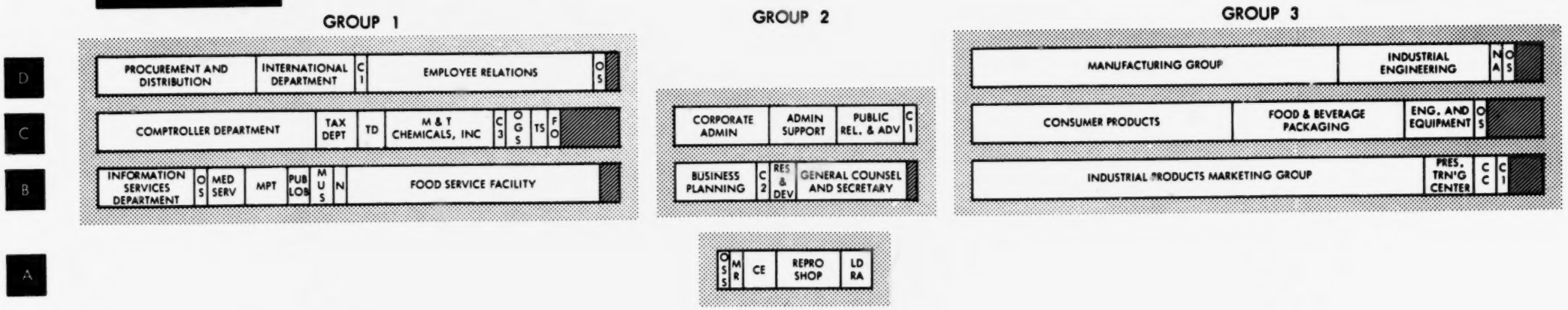
This firm uses several techniques for developing detailed occupancy information. One of these is a method for establishing the preferred relationship of various activities. Three ratings are requested from client personnel:

1 Essential adjacency, which means it is imperative that the two departments be physically close in order to operate effectively.
2 Important adjacency, which means it would be highly desirable if the departments could be physically close or on adjacent floors.
3 Convenient, which means it would be convenient if the two departments were physically close, but effectiveness would not be impaired by separation.

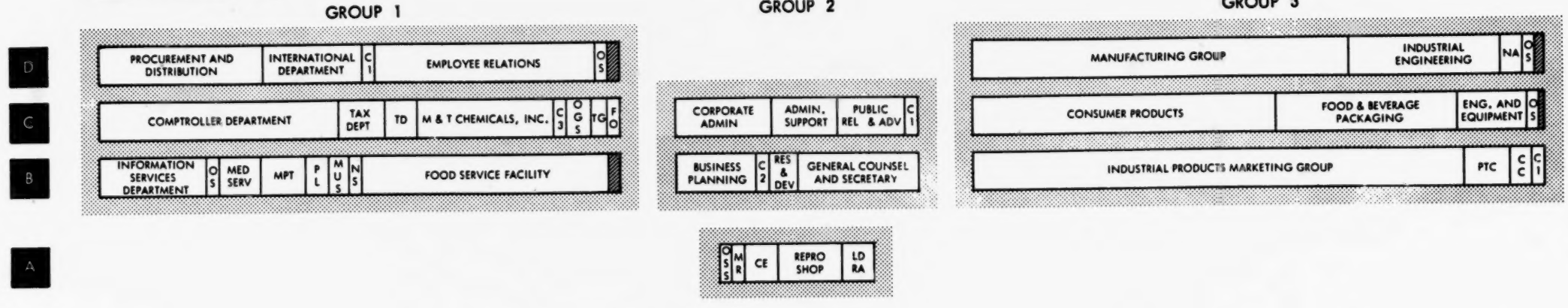
Another technique used is the reporting of staff work flow and visitor traffic requirements by each client unit. The amount of visitor traffic received by each unit is a factor in determining departmental locations with respect to each other as well as to entrance, elevator and reception facilities.

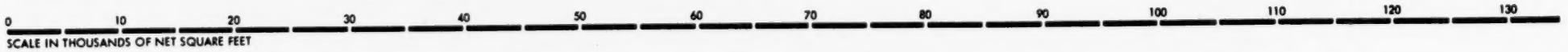
In the final analysis, this firm uses a "Functional Groupings" diagram to graphically express the relationships of the activities previously analyzed. The "Functional Groupings" chart shows the characteristics of the analysis in terms of optimum floor sizes, adjacency, traffic, total net area and the breakdown in assigned net area and expansion space. On complex programs, computer analysis is utilized in developing these solutions. These theoretical diagrams have proven very useful to the architects involved.

1970 OCCUPANCY



1975 OCCUPANCY





	REPORT STANDARD	POSSIBLE BUILDING MODULE						
		3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"
1970	315,064	317,790	318,293	318,162	316,722	319,590	325,697	319,472
1975	331,521	334,415	335,099	334,965	333,293	336,439	343,109	336,313
1980	345,612	348,639	349,582	349,466	347,572	350,934	358,176	350,829

ABBREVIATIONS

C1 - SHARED 12 PERSON CONF ROOM	MUS - MUSEUM
C2 - SHARED 20 PERSON CONF ROOM	NA - NATIONAL ACCOUNTS
C3 - SHARED 30 PERSON CONF ROOM	NS - NOTIONS SHOP
CC - CONFERENCE CENTER	OS - OFFICE SERVICE SATELLITE
CE - CENTREX EQUIPMENT	OSS - OFFICE SUPPLY STORAGE
FO - FACILITIES OFFICE	PL - PUBLIC LOBBY
LDRA - LOADING DOCK & RECEIVING AREA	PTC - PRESENTATION & TRAINING CENTER
MPT - MGMT PROF & TECH PERS ADMIN	TD - TREASURY DEPARTMENT
EXPANSION SPACE	

FUNCTIONAL GROUPINGS SOLUTION A

BECKER AND BECKER ASSOCIATES, NEW YORK AND LONDON

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PART 2

CHAPTER 4

Emerging Techniques of Architectural Programming

LIST OF TECHNIQUES AND EXHIBITS

The search and investigation for emerging techniques made by Professor Wheeler resulted in the gathering of, and identification of, techniques from various sources. The material was screened and placed into six categories. The 55 techniques described and shown here are typical of the techniques used by architectural firms and their consultants.

DISCUSSION OF TECHNIQUES GROUPS

Group "A" Techniques:

1 Network Plan for Programming Phase Exhibit 1
2 Programming Manual
3 Sequence of Program Documents Exhibit 2
4 Concept Phase Development Procedure
5 Program Development Format
6 Guide to Preparation of Program
7 Outline of Procedure
8 Link Analysis Symbols Exhibit 3
9 Flow Chart Symbols Exhibit 4

Group "B" Techniques:

10 Building Type Comparison Chart
11 Constraint Diagrams — Planning Exhibit 5
12 Variable Planning Factors Data
13 Vocabulary of Critical Dimensions Exhibit 6

Group "C" Techniques:

14 Planning Path Exhibit 7
15 Design Study Charts Exhibit 8
16 Planning System Diagram Exhibit 9
17 Study Organization Chart Exhibit 10

Group "D" Techniques:

18 Specific Room Data Forms Exhibit 11
19 Room Requirements Format Exhibit 12
20 Equipment and Services Chart Exhibit 13
21 Standard Room Requirements Form Exhibit 14
22 Space Criteria Sheets Exhibit 15
23 Equipment and Case Work Checklist Exhibit 16
24 Building History Investigations
25 Programming Questionnaire Format
26 Program Requirements Booklet
27 Architect's Presentation of Questions
28 Space-Time Log Exhibit 17
29 Tracking Studies Exhibit 18
30 Links Related to Methods of Communication Exhibit 19
31 Ultimate Land Use Investigations
32 Population Trend Investigations Exhibit 20

Group "E" Techniques:

33 Departmental Linkages Exhibit 21
34 Room Relationship Matrix for Closeness and Reason Exhibit 22
35 Inter-Communication and Personal Movement Chart Exhibit 23
36 Management Relationship Analysis Exhibit 24
37 Functional Relationship Analysis Exhibit 25
38 Plant Function Diagrams by Phases Exhibit 26
39 Space Relationship Diagram Exhibit 27
40 Activity Relationship Analysis Exhibit 28
41 Functional Plant Layout Analysis
42 Operations Research Analysis
43 Schematic Master Plan Layout Exhibit 29
44 Travel Charting and Analysis
45 Movement Analysis Exhibit 30
46 Traffic Distribution Analysis Exhibit 31
47 Minimum Path Analysis Exhibit 32
48 Traffic Survey and Analysis Exhibit 33
49 Traffic Inter-Connection Analysis Exhibit 34
50 Desire-Line Analysis Exhibit 35

Group "F" Techniques:

51 Geographical Identification and Coding Exhibit 36
52 Orientation Graphics Exhibit 37
53 Projected Occupancy and Building Capacities Exhibit 38
54 Graphic Representation of Traffic Volumes Exhibit 39
55 Project Time Scheduling Exhibit 40

References

Discussion of Techniques Groups

Grouping of Techniques

The search for techniques used in programming revealed many techniques which may be considered old or new according to the expertise of individual architects. It seemed desirable to group them so that they could be identified, assembled, and presented herein. The search also exposed the procedures used in architectural programming and the examination of such procedures gave insight into, not only the characteristics of architectural programming, but also, the qualifications of architectural programmers.

Sources for Techniques

The techniques were not found in one region or in one type of work or in one type of architectural practice. On the contrary, the emerging techniques of architectural programming appear to come from many different sources.

Programming Stems from Experience

After examining programs and talking to programmers, it became apparent that good programming stems from the programmer's prior experience. It results from the programmer's capability and competence to use standard procedures and systematic practices as well as data banks and feedback information which is indicative of his sensitivity in a specific building type area.

Groups of Techniques for Preparation of an Architectural Program

The remaining groups of techniques used in architectural programming pertain to the preparation of the architectural program. Grouped in their most simple form, they are: (a) planning techniques, (b) investigative techniques, (c) analytical techniques, and (d) presentation techniques. Many techniques can be used in several of these groupings. For instance, a technique of investigation involving a procedure or format may become a good analytical technique because of that procedure and format. Likewise, the same technique, if clearly presented by the procedure and format, also may be a good presentation technique. In fact, as the architectural programmer becomes more experienced in architectural programming, he stylizes his techniques and procedures to expedite his work as well as lessen the possibilities of error and omission.

Two Categories of Programming Techniques

The techniques seem to fit into two categories: (a) those which pertain to the preparations made by the programmer prior to programming a specific architectural project, and (b) those which pertain to programming a specific project. Therefore, it was decided to identify, assemble, and correlate the techniques used by architectural programmers prior to the actual assignment of the architectural programming project — as shown in the first two groups.

Techniques of Using Standard Procedures, Group "A"

The repetitive nature of programming projects makes it desirable for the programmer to have a standard procedure. It is desirable also that he make effective use of the new techniques of network planning, procedural manuals, standard guides, standardization of symbols, and so on. Such techniques are described in Group "A."

Data Banking Techniques, Group "B"

The capability of the programmer is built upon each experience, especially the total experience from start of investigation to evaluation of feedback information which returns to the programmer after the building is completed. The use of feedback information and the application of statistics, unit costs, successful programming data, and "as built" information places the programmer in an advanced standing to plan and prepare the next architectural program. Such techniques as the assembly of planning standard manuals, investigations of planning factors, assembly of comparative information on prior building type designs, and the various standard vocabularies resulting from design experience all become techniques for architectural project programming. The use of prior information lessens the amount of "re-inventing the wheel" which goes on in the custom design of buildings.

Planning Techniques Group "C"

The techniques of planning reveal the programmer's competency for tackling the problem. Such planning involves the typical procedures of: (a) defining objectives, (b) determining work involved, (c) planning the sequence of work, and (d) preparing the presentation. Group "C" techniques consist of planning paths, planning diagrams, networks, organizational charts, and so on; and, they provide for a more orderly and systematic procedure for programming.

Investigative Techniques, Group "D"

The essence of programming lies in the art of searching, investigating, and questioning. Establishing good channels of communication and vocabularies for mutual understanding by user and designer reveals the programmer's sensitivity to the client's needs. Investigative techniques shown in Group "D" range from standard forms, formats, and data gathering methods to procedures, checklists, criteria sheets, and such items which are useful on effective and objective investigations. When investigations require novel solutions, it is necessary for the programmer to use new techniques such as: tracking, space-time logging, client education, trend estimating, and so on. This aspect of programming is based solidly on the art of questioning, but it also depends, in great measure, upon the use of scientific techniques and business-like methods.

Analytical Techniques, Group "E"

The assembly of raw investigative data requires expert analysis. In fact, the more expert the investigation, the more diverse and complicated becomes the accumulation of written and graphic data. In this respect, the Group "E" techniques, such as screening, abstracting, correlating, comparing, and analyzing become necessary to manage, manipulate, and use the investigative material. The use of scientific analysis is not always a qualification of the good investigator, but it is a required qualification of a good analyzer. A good analyzer requires sensitivity to occupants and building functions because he is required to establish: (a) categories of function, (b) degrees of importance, (c) priorities of use, or (d) delicate value systems. The techniques of charting, graphing, diagramming, visualizing, linking, relating, analyzing, and so on are necessary to organize data and bring the significant factors "out of the woods."

Presentation Techniques, Group "F"

Presentation techniques, *per se*, are the by-product of: (a) the program analysis talent and (b) the conceptual designer's visual ability. The architecturally-trained programmer makes orderly presentations using new techniques of printing, reproduction, graphics, and so on. He accentuates the important elements of the program and shows the breadth, width, and depth of the investigation without confusing the decision makers. Lastly, he portrays the thoroughness and completeness of the investigation. The techniques of documentation and communication are especially important in presenting effectively the architectural program which always should be a presentation combining written, graphic, and orally presented material.

Group "A" Techniques

TECHNIQUES FOR STANDARDIZATION OF ARCHITECTURAL PROGRAMMING

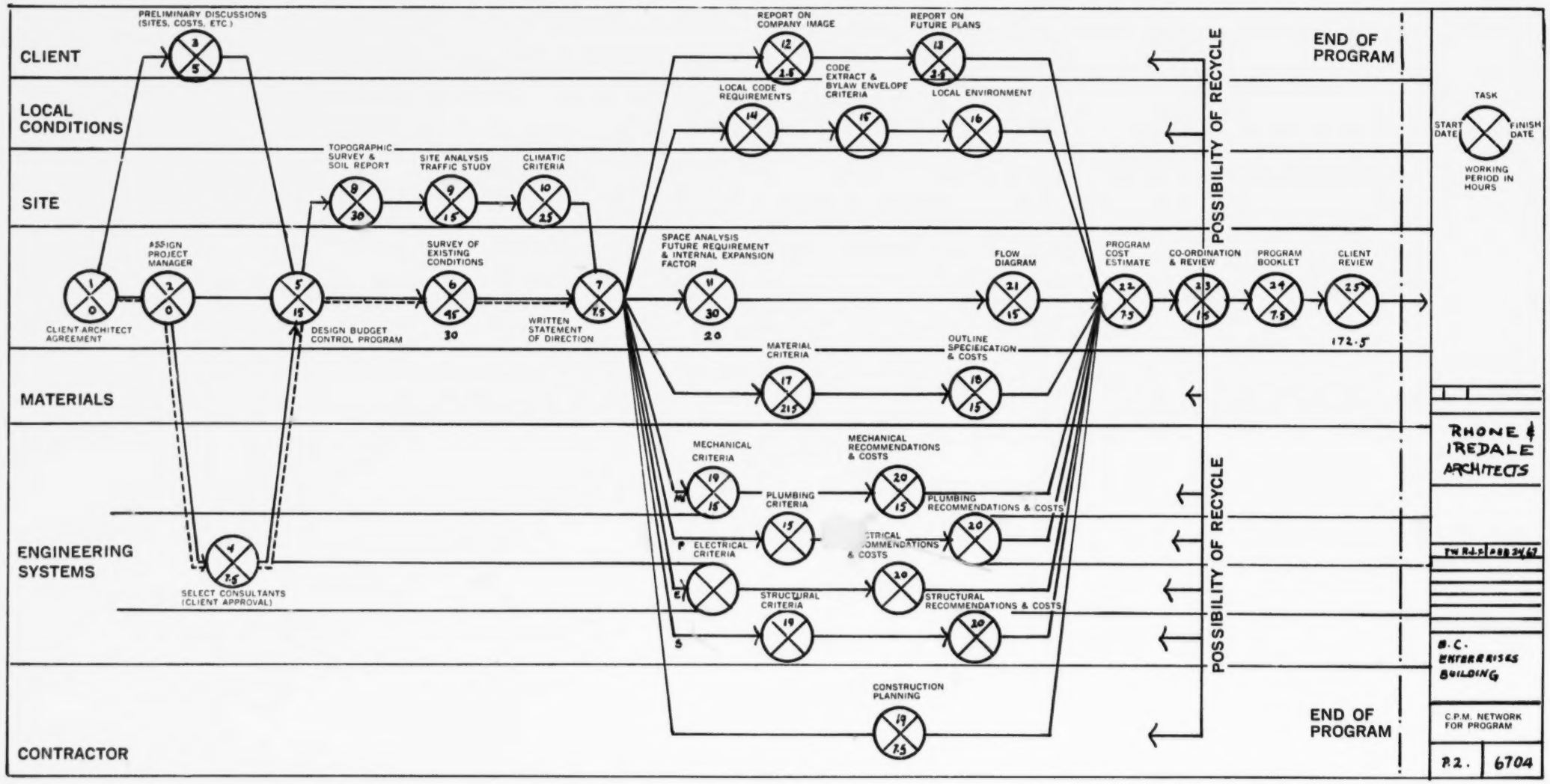
Technique No. 1

"NETWORK PLAN FOR PROGRAMMING PHASE"

One architectural firm has developed a network plan for the architectural services, as shown in exhibit 1. The network is divided into horizontal functions or responsibilities. Reading vertically down, the responsibility bands are: client, local conditions, site, the architect's function, materials, engineering systems, and contractor.

Horizontally the network shows the sequence of activities starting with the client-architect agreement, proceeding to preliminary discussions with a client, assignment of team personnel, selection of consultants, design of budget control program, securing surveys, site analysis studies, climatic data, and so on. These activities lead up to a written statement of direction (for the program) which, when approved, initiates the various investigations of such items as client's programs and goals as well as code and jurisdictional requirements. Then, it proceeds with the full investigation of spaces and considers materials, specifications, and costs on all architectural items as well as all of the engineering and technical subjects. All of the above investigations are assembled in the form of a "program

Exhibit 1
NETWORK PLAN FOR PROGRAMMING



cost estimate." The program is reviewed and coordinated, and then re-cycled if necessary. Finally, it is prepared into a program booklet which is made ready for client review and approval.

The nodes of the network are designed so that the characteristics of the task can be added. The task number is at the top and the budgeted working hours are shown at the bottom. The starting date is on the left and the finishing date is on the right. — *Ref. 1*

Technique No. 2

"PROGRAMMING MANUAL"

One architectural firm has prepared a standard procedure and format for programming. At the start of each project, the firm assembles a document entitled "General Information and Programming Manual" which is custom prepared for clients and the architect's staff.

This manual provides general information on the probable design concepts of the building. To stimulate thought, the manual usually provides a site plan and a block model photograph. It provides for discussions of the client's objectives for: (a) improvement of operational efficiency, (b) provision for adequate, efficient, and flexible space, and (c) establishment of a functional, comfortable, and attractive working environment. The document also discusses the development of a project having an identity as well as architectural merit, dignity, stability, and so on. The preliminary and general information includes a discussion of a building module with relation to movable partitions, lighting, air conditioning, exterior fenestration, and so on. It even illustrates the module and discusses space layouts, sizes, shapes, configurations, and so on. All of the above is preliminary to a discussion of programming as a joint effort between architect and client.

The second section discusses an approach to programming and a procedure for arriving at precise understandings of aims and requirements. It suggests: (a) the development of a general plan and, then, (b) the preparation of a detailed procedure for confirming understandings and techniques for the establishment of a building program. It also sets forth the basic flow pattern for liaison between client and architect. The programming approach suggests a beginning with: (a) a departmental review by department heads and, then, (b) the selection of coordinators for departments to act as liaison with the architect.

The basic responsibilities for program development are discussed and established in the next section which is divided into nine areas of program responsibility.

The responsibilities of the architect are:

1 to schedule and coordinate the acquisition of program data,
2 to obtain plans for existing space, and
3 to perform physical survey of existing space.

The responsibilities of the client's representatives are:

4 to develop organization charts,
5 to conduct foot-traffic survey, and
6 to suggest guidelines for size of private or specialized spaces.

The joint responsibilities of the architect and client are:

7 to complete special forms (described below) indicating present and future space and personnel requirements,
8 to review checklist of special facilities, and
9 to suggest guidelines for a program of furnishings.

The programming manual ends with a section on the methods of preparing data, instructions on the preparation of client's organization charts, examples of client's organization charts, instructions on department charting, instructions on the preparation of traffic surveys, and so on. The manual includes copies of five standard data-gathering forms which have been designed to assist the client to acquire, record, summarize, and transmit information. — *Ref. 2*

Technique No. 3

"SEQUENCE OF PROGRAM DOCUMENTS"

A consultant in the field of medical center and hospital programming has developed a procedure which defines the "sequence of decision program steps" as shown in Exhibit 2. The significance of programming by steps is highlighted by the growing complexity of certain building types. This exhibit identifies not only the programming documents, but also the process studies necessary to establish the program.

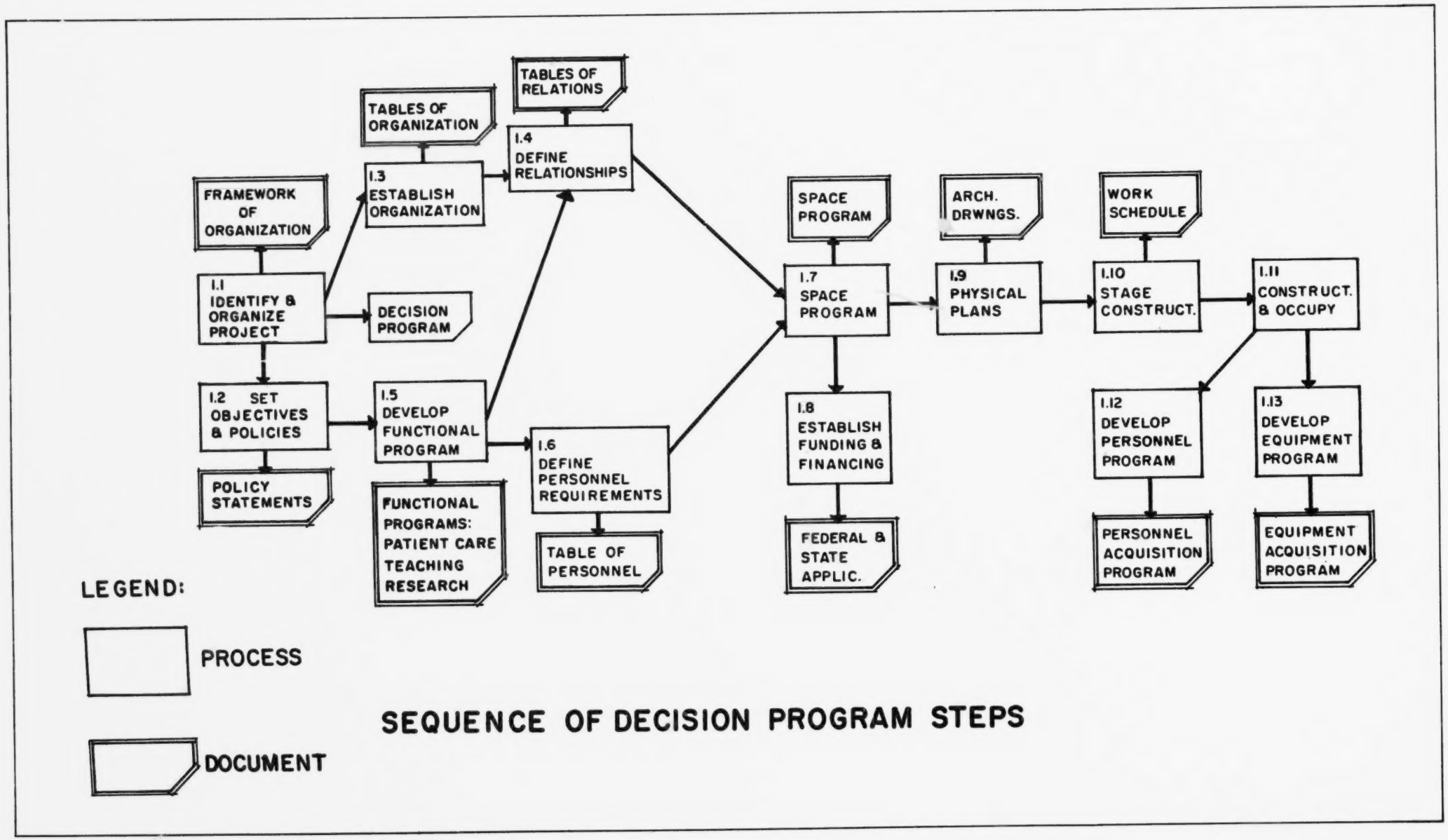
The first document generated pertains to the identification of the project and is entitled:

1 Decision Program.

During the organization of the project the firm produces:

2 "Framework of Organization" and
3 "Policy Statements."

Exhibit 2
SEQUENCE OF DECISION PROGRAM STEPS



Other early program documents are:
4 Table of Organization,
5 Functional Programs,
6 Table of Relations, and
7 Table of Personnel.

The primary program documents then are prepared for approval and action, as follows:
8 Space Program,
9 Funding Program, and
10 Architectural Schematics

Other programming work accomplished later includes such documents as:
11 Construction Schedule,
12 Equipment Acquisition Program, and
13 Personnel Acquisition Program. — *Ref. 3*

Technique No. 4

"CONCEPT PHASE DEVELOPMENT PROCEDURE"

A typical example of the office procedures, guides, and statements of function which have been prepared by architectural firms to clarify the responsibilities for programming is the first section of a management document, "concept phase development procedure," prepared by one A-E firm. The procedure: (a) defines the work of the phase and (b) delegates the responsibilities for the first phase of services. This firm names a project director to take overall responsibility for the project and a director of production to maintain administrative contracts during the programming phase as well as the other phases. However, the firm names an architectural designer-programmer, with assistance from others as needed, to actually take the lead in the project, meeting with the client and the project director as often as needed to establish the program.

The fact-finding work includes the assembly of site information, such as: topographic surveys, soil borings, utilities, deed restrictions, zoning, building codes, insurance requirements, Department of Health regulations, Fire Marshall regulations, and restrictions of other local, State, and Federal authorizing or approving agencies. It also includes a site inspection. The architectural designer-programmer also obtains the owner's requirements and a budget.

As the result of all of the above, he prepares a written program and obtains approval of client and other key members of the architect's organization. He prepares "thumb nail sketches" and a rough estimate of cost. He reviews and consults frequently with the client, director of production, and project director to make certain that their thoughts and desires are being met. During the above described "thumb nail sketch" steps, the architectural designer works more or less on his own, obtaining such general information as he thinks he needs from engineers and others to make reasonably certain that their general requirements are not overlooked.

He is primarily engaged in getting something down on paper that appears to meet the client's general requirements and can serve as the basis of sound design — at the least possible cost and effort to the office. But, he proceeds to review his "thumb nail sketches" with engineers, site planners, and all concerned and attempts to determine whether the job will be modular-coordinated or not.

The concept phase then appears to narrow down to "thumb nail sketch" drawings, called "concepts," which are supported by floor plans, elevations, rough perspective, plot plan, such written memorandums or notes as necessary to explain the basic design considerations, and "an estimate of cost based on square footage." All of this is then reviewed and approval is obtained from the client, the architectural firm's associates, and approving agencies.

The Document describes the final work of the concept phase which includes the preparation of an analysis of the future work on the job including: (a) a listing of each sheet of drawings that will be required during schematics, (b) a description of any special problems anticipated, and (c) an estimate of time and budget which will be required during the preparation of schematics and subsequent phases. The programming work ends with a "meeting of minds" on the sketches, program analysis, and budget. — *Ref. 4*

Technique No. 5

"PROGRAM DEVELOPMENT FORMAT"

One architectural firm has developed a series of seven large forms which are used by its programmers in the investigation and the preparation of an architectural program. Each form is 11" x 17" and printed on reproducible paper which can be filled in and later printed. Each form fulfills a certain purpose in the fact-finding search, development of requirements, and analysis of data. A description of the seven forms follows:

Form 1 — "Code and Standards Program" is a checklist of all possible codes, agencies, and standards which may be applicable to the job. This form is used to check off applicable and non-applicable regulations. It also lists such items as fire protection codes, elevator codes, public health service regulations, guides, building codes, and so on.

Form 2 — "Code and Standards Program (con't.)" is a form which provides space for the layout of the site data including information on restrictions, easements, setbacks, and so on. It provides a checklist of important criteria which may be governed by codes and regulations. It also provides a checklist on occupancy requirements for exits, stairways, hallways, special conditions, and so on.

Form 3 — is a room analysis form which requires the listing of rooms in a five-column form and has space for the identification of rooms, dimensions, materials and finishes, services, utilities, and general remarks.

Form 4 — is another format sheet used for architectural sketches of walls, floors, panels, roofs, and other items which are needed to determine "U" factors, glass areas, sound transmission, characteristics, and so on.

Form 5 — is a mechanical systems sheet which has space for diagrams and schematics to show the peculiarities of the various mechanical and electrical systems, (HVA/G, plumbing, power, and so on).

Form 6 — is a format sheet used to show the functional relation of spaces and other diagrams made by the programmers to record probable relationships of spaces.

Form 7 — is a sheet made in the form of paint and color schedules to record the various types of interior information which are considered important criteria as far as the owner's requirements are concerned. — *Ref. 5*

Technique No. 6

"GUIDE TO PREPARATION OF PROGRAM"

One architectural firm which has developed a competency in hospital design has developed an extensive guide for the development of programs and planning requirements. The guide described here is prefaced with instructions on definitions, objectives, responsibilities, and methods.

The guide is used as a vehicle by which the owner's representatives and the architect's representatives can communicate with each other and become jointly familiar with the overall procedures for developing the program.

The guide is used also as the format or outline for the investigation. It includes statements about geographic area and population, hospital resources, limitations, required conclusions, and building history investigations.

The guide is divided into sections representing departments according to the function. It asks pointed questions, and requests definitions, functions, and responsibilities. Throughout the guide are reminders such as "consider circulation," "define functions," "consider work flow," "consider relationships," "choose consultants," "make decisions," "state responsibilities," and so on.

The guide describes certain supplemental data which is usually required, such as:

- site description and documents,
- applicable zoning restrictions,
- tabulated summary of program requirements,
- scale area representation which provides a visual comparison of areas of different departments, and
- a space needs review, and so on. — *Ref. 6*

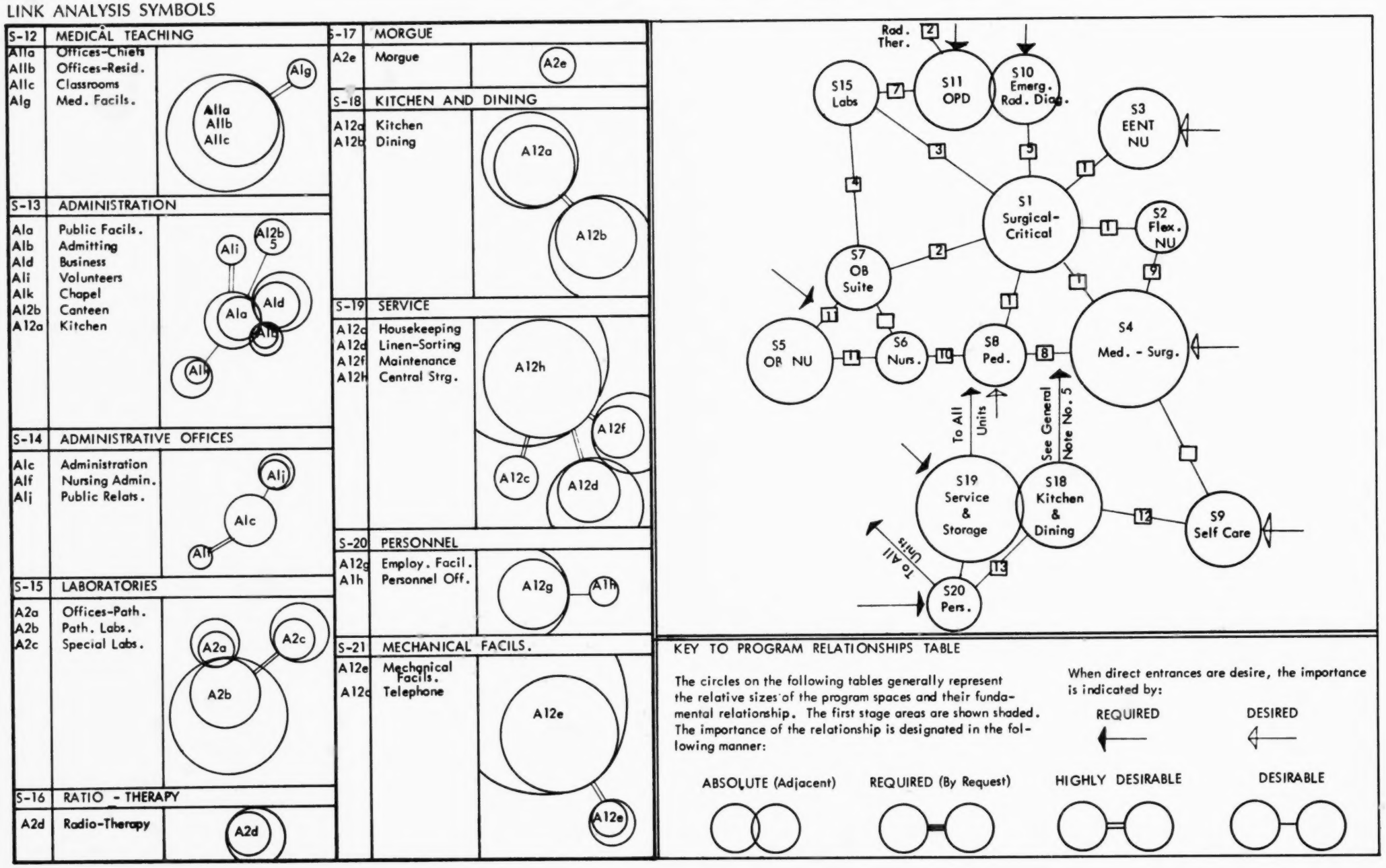
Technique No. 7

"OUTLINE OF PROCEDURE"

The outline of procedure used by one architectural firm in the development of long range plans is typical of the systematic approach which firms use in program development. This procedure shows the interaction between client's representatives, building committee, and the architect's staff in such a way as to permit all interested parties having responsibilities to carry out their part of the procedure — from investigation and analysis to planning and reporting of the program effort.

The procedure includes: (a) an investigation of orientation and (b) the basic determinates (or the ground rules) upon which the entire project is developed. It also includes an evaluation of exist-

Exhibit 3
LINK ANALYSIS SYMBOLS



ing facilities and the preparation of the functional program which is a clear statement of needs for each of the major departments or elements and often goes as far as describing traffic, services, people, public characteristics, and other considerations which affect the ultimate design. The study includes an analysis of gross floor area for existing buildings as well as an analysis for each stage of development, budget estimates, and proposed schedules. — *Ref. 7*

Technique No. 8

"LINK ANALYSIS SYMBOLS"

The repeated use of diagrams to show relationships requires that architectural firms standardize symbols for their own work. One firm developed a system of "link analysis symbols," as shown in Exhibit 3, which identifies: (a) size of spaces by circles, (b) stages of

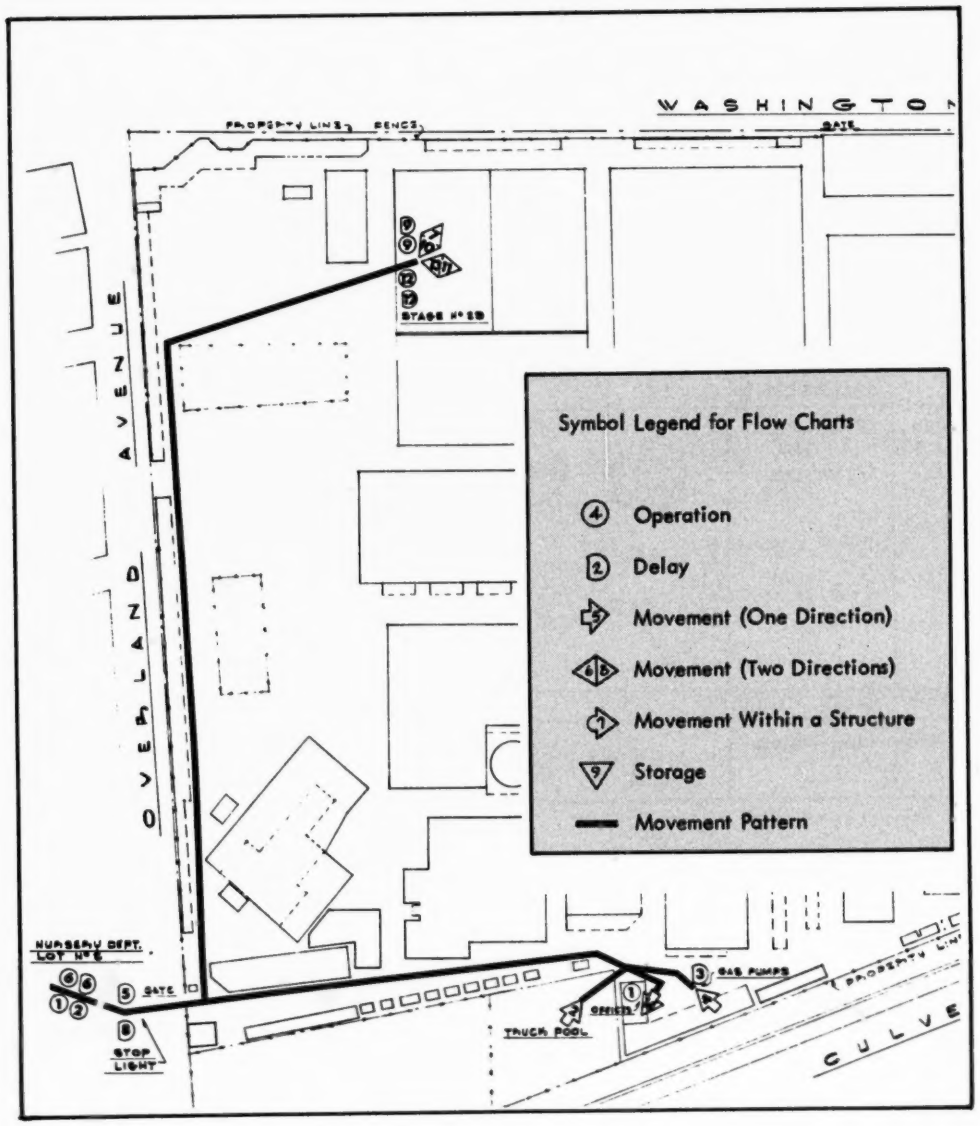
construction by shading, (c) the importance of relationships by attachment lines, and (d) entrance requirements by arrow types. Symbols are explained and two applications of the symbols are included to show program relationships. The diagrams illustrated were of major subsystems or relationships which, in turn, were diagrammed in a simplified, comprehensive manner for the entire hospital. — *Ref. 8*

Technique No. 9

"FLOW CHART SYMBOLS"

Other types of symbols used by architectural firms who show flow of people or materials are "flow chart symbols." Examples of one firm's symbols are shown in Exhibit 4, which also describes the application of the symbols to show movement patterns identified by the symbols. — *Ref. 9*

Exhibit 4
FLOW CHART SYMBOLS



Group "B" Techniques

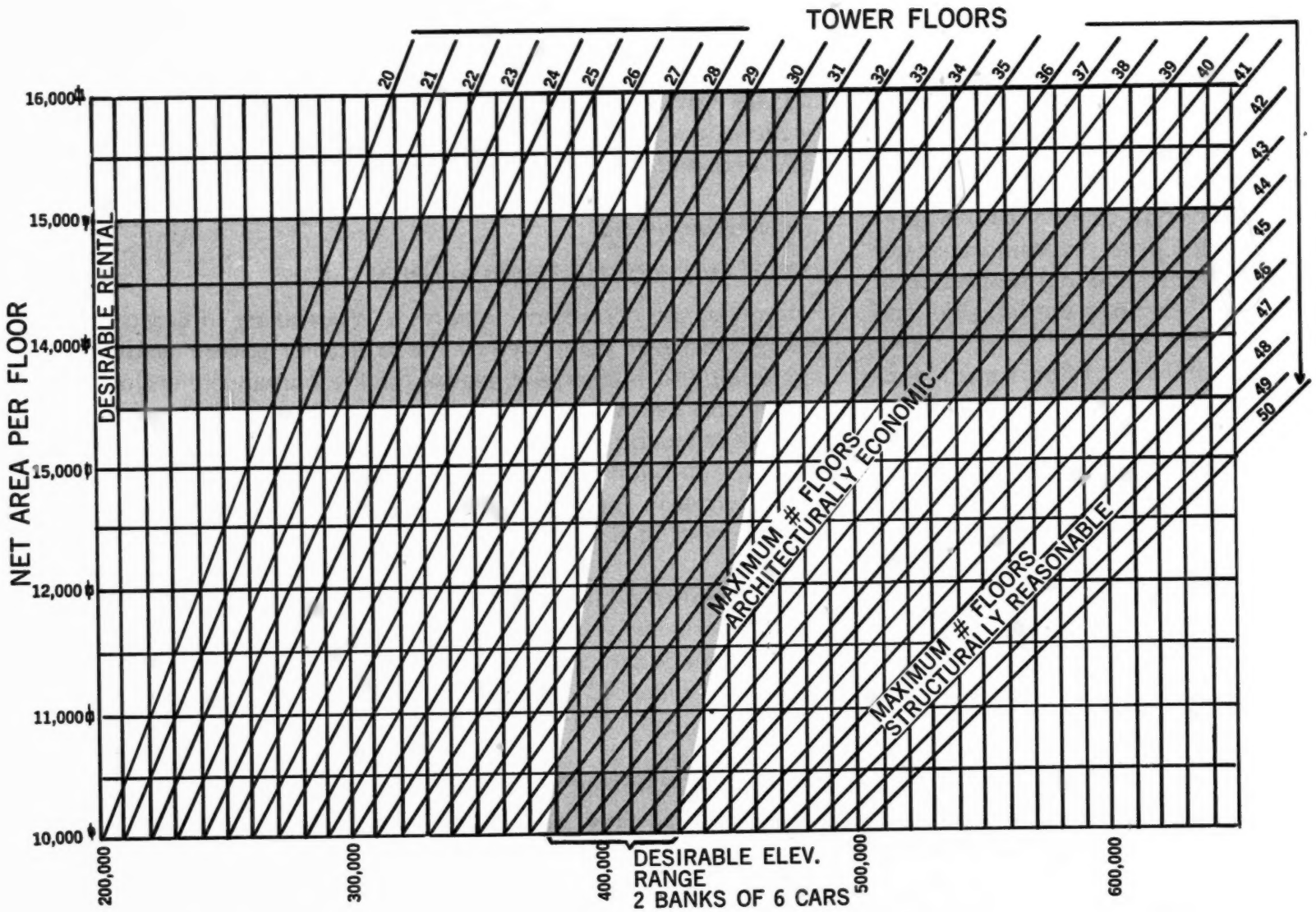
DATA BANKING TECHNIQUES

Technique No. 10

"BUILDING TYPE COMPARISON CHART"

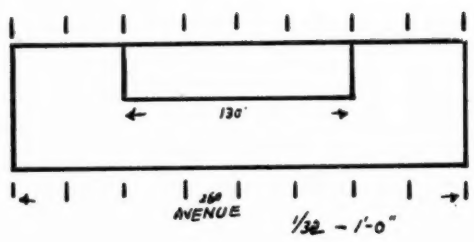
One type of data banking involves the keeping of unit information per types of buildings and preparation of charts comparing previously designed and constructed buildings. An engineering consulting firm compares by charts such items as the structural steel in a building by pounds per square foot of floor area for certain types and heights of buildings. Such a comparison chart is the stock-in-trade of individual designers who have analyzed their prior work and other work to determine the basic parameters of design which are then used in conceptual design and building programming. Design firms, which keep records of unit factors and costs of their prior work in an orderly and systematic procedure, assemble unit comparisons quickly and easily during the programming stage of new projects. — *Ref. 10*

Exhibit 5
CONSTRAINT DIAGRAMS-PLANNING



TOWER SUMMARY

GROSS FLOORS: 34
NET FLOORS: 31
GROSS AREA/FLOOR: 18,200
NET AREA/FLOOR: 14,560
TOTAL GROSS AREA: 622,700
TOTAL NET AREA: 451,360



PROJECT 2009 BUILD

Technique No. 11

"CONSTRAINT DIAGRAMS — PLANNING"

As certain building types become more specialized, such as the typical tower-type of office building, general planning and design information is being diagrammed in such a way as to be a guide for program development and the preliminary selection of building size and configuration. One such type of constraint diagram prepared by an architectural firm in conjunction with its structural engineering consultant is shown on Exhibit 5. The typical floor plan explains the building layout, floor dimensions, number of elevators, and so on. The "constraint diagram" describes the comprehensive study of such factors as: (a) the net tower area along the bottom of the chart, (b) the net area of a typical floor along the left side, and (c) the number of floors diagonally.

Certain diagonal lines denoting the number of floors are identified as maximum and minimum with regard to structural economy or structural reasonableness. Superimposed on the constraint chart are two, broad, gray bands. One shows the limits of desirability for a bank of elevator cars (in the vertical dimension) and the other band shows the desirable rental range for certain floor areas (in the horizontal dimension). The parallelogram formed by the intersection of the two gray bands defines the probable limits of feasibility for this specific building configuration. — *Ref. 11*

Technique No. 12

"VARIABLE PLANNING FACTORS DATA"

Architectural firms, clients, and consultants keep records of, and assemble data on, many planning factors described in the referenced article on the subject of a special study of variable planning factors. The two-year study involved an analysis of many factors in hospital operations and design and resulted in the development of a set of findings which included: (a) admission rates per year per thousand per type of medical care, (b) bed requirements per day per thousand, (c) length of hospitalization per surgical procedure, and so on. The data assembled was accomplished by "rules of thumb" information which was computed from the basic statistics secured during the investigation. The study also demonstrated some practical applications of the factors developed and showed how their use depends upon the ingenuity of the planner or programmer.

This technique for programmers is characterized by the accumulation of feedback data which is assembled in such a way as to help in future programming. Architectural programmers usually examine planning factors for a series of similar types of building complexes.

This study also shows a comparison between several items such as: (a) how many deliveries per month, (b) how many surgical procedures per bed occupancy, (c) how many staff physicians needed per bed, and so on. — *Ref. 12*

Technique No. 13

"VOCABULARY OF CRITICAL DIMENSIONS"

One program consultant prepares a "Vocabulary of Critical Dimensions" which is comprised of the critical or governing dimensions pertaining to human engineering or the human dimensions of the occupants who will use the architectural space and its equipment as shown in Exhibit 6. Such vocabularies may vary greatly from building type to building type. The dimensions usually pertain to secretarial work in offices, surgeons' work in operating rooms, craftsmen's work in shops, materials handlers' work in warehouses, and so on.

Also shown on this exhibit is an example of the application of the critical dimensions to a specific function. The second series of diagrammatic sketches is entitled "Dimensional Analysis — Dentist Station." — *Ref. 13*

Group "C" Techniques

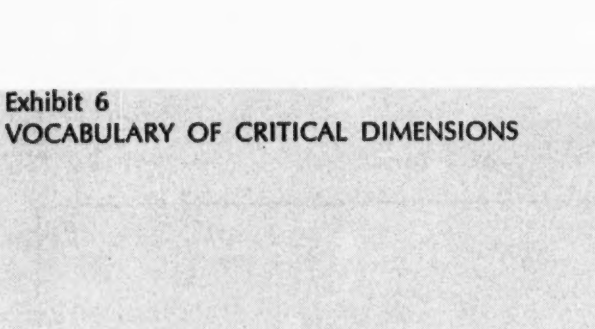
TECHNIQUES FOR PLANNING THE ARCHITECTURAL PROGRAM

Technique No. 14

"A PLANNING PATH"

Being able to establish the sequence of thinking and a systematic approach to the programming is unquestionably the architect's role in the development of the program. Exhibit 7 shows one architect's diagrammatic concept of the development of a plan for a building program. The sequence goes from problems through objectives through opportunity areas through yard sticks through projections

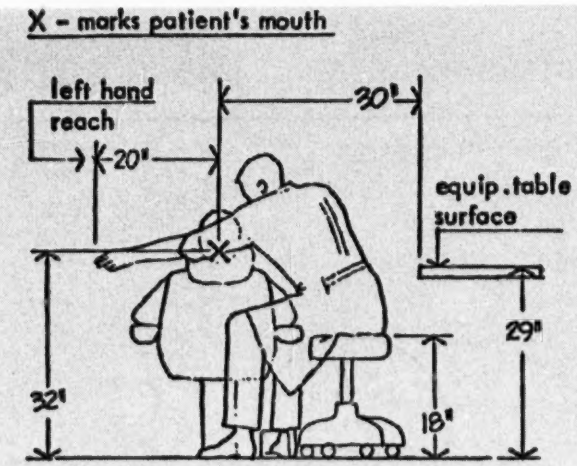
Exhibit 6
VOCABULARY OF CRITICAL DIMENSIONS



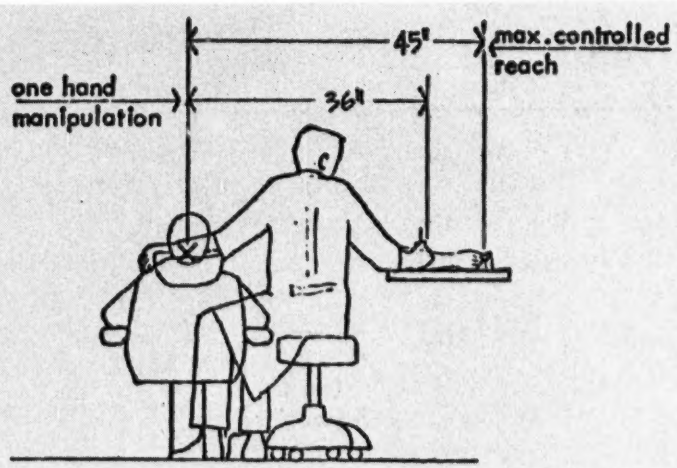
Standing at High Bench
A. Standing erect with forearms horizontal manipulating at edge of bench.
B. Standing bent over for close work at edge of bench.
C. Standing erect with hands at eyelevel manipulating at edge of bench.
D. Leaning over bench with sufficient balance to manipulate at arm's length.

Seated at Low Bench
E. Seated with normal study posture — dimensions apply to typewriter use and high stool at bench also.
F. Rising from sitting position with sufficient clearance for legs.

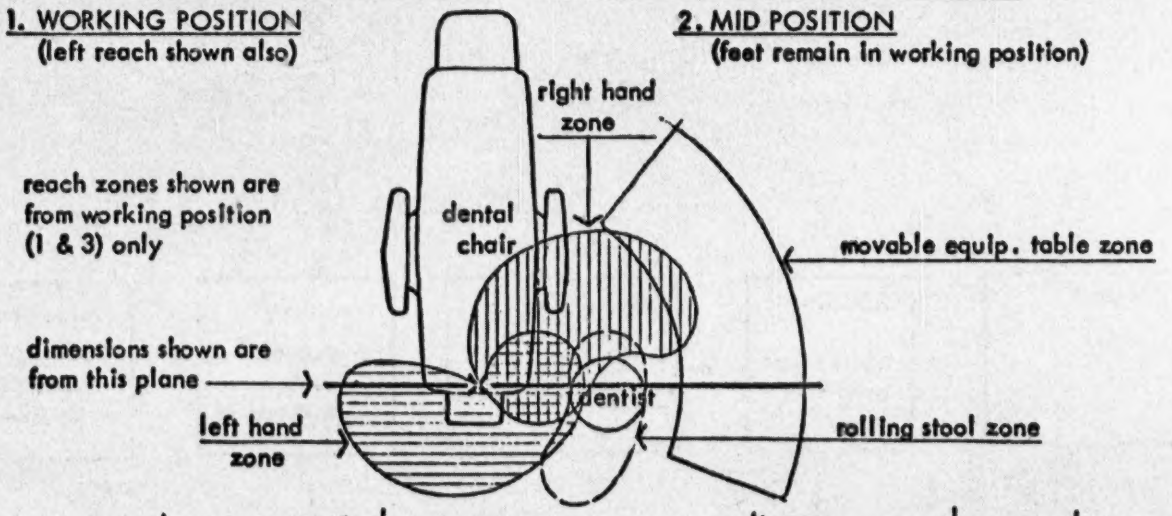
A "Vocabulary of Critical Dimensions" developed as an aid in laboratory planning.



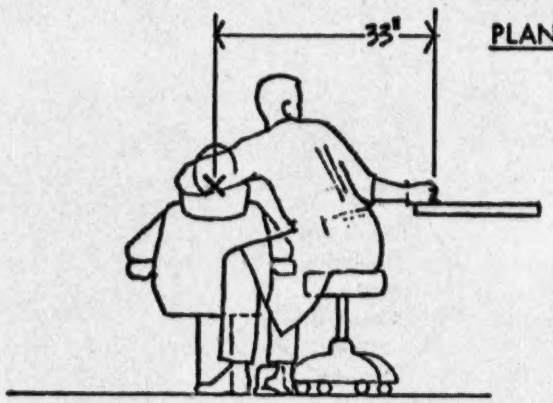
1. WORKING POSITION
(left reach shown also)



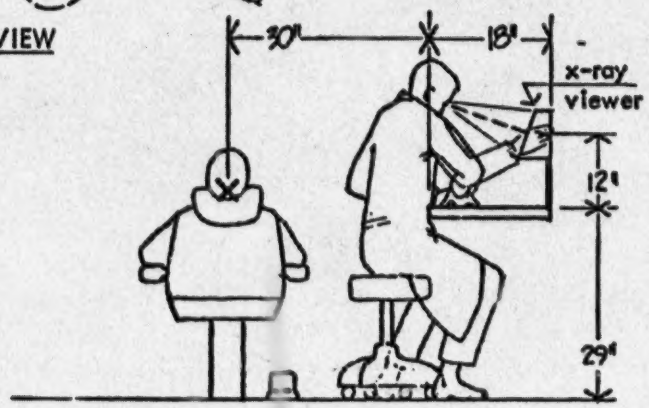
2. MID POSITION
(feet remain in working position)



PLAN VIEW



3. RT. REACH from WORKING POSITION

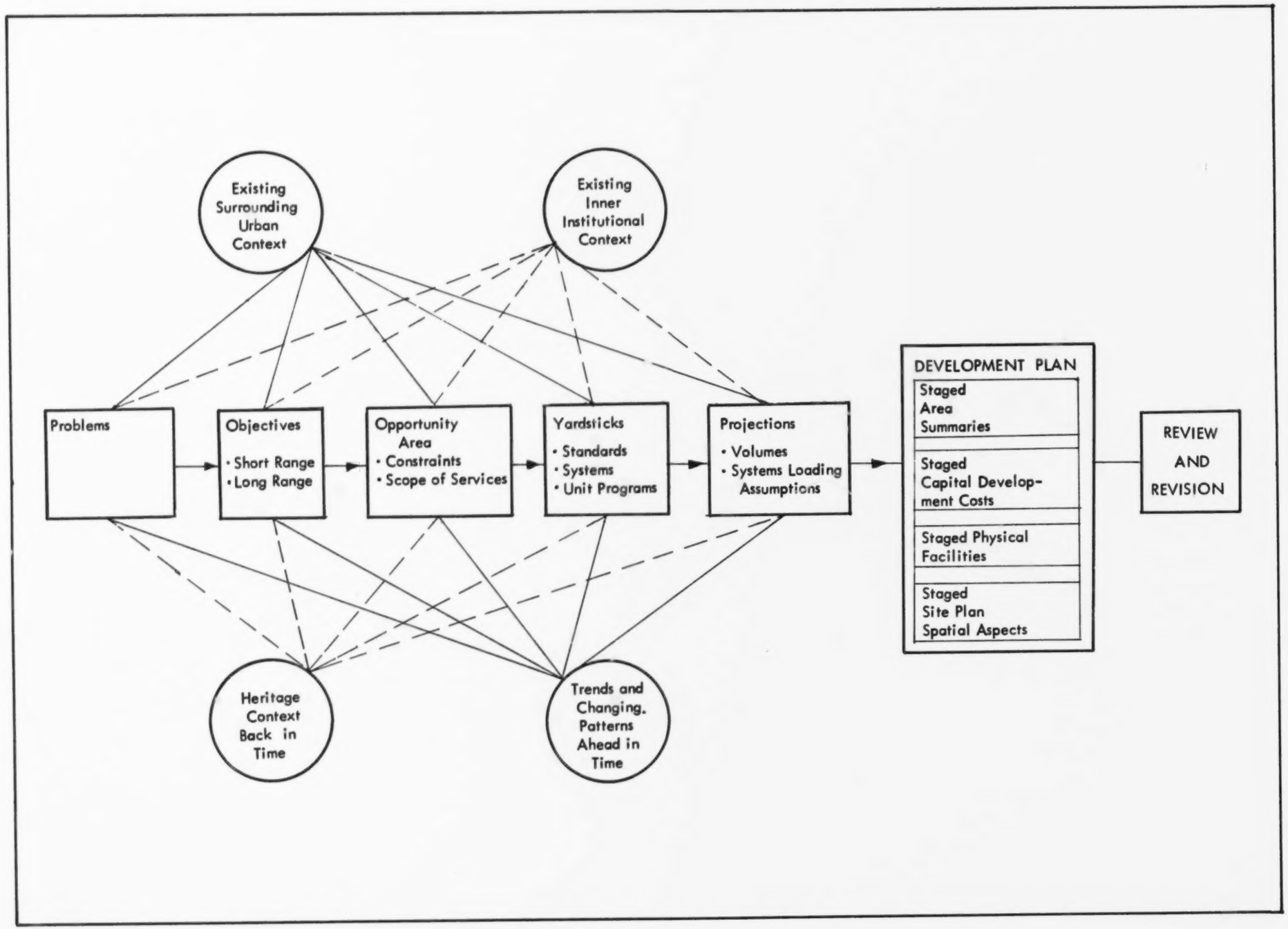


4. BENCH WORK POSITION
(reach & sight to x-ray viewer)

DIMENSIONAL ANALYSIS - DENTIST STATION, PORTABLE EQUIP. TABLE, SEATED DENTIST

LESTER GORSLINE · ASSOCIATES · INTERNATIONAL
WEST HARTFORD CONNECTICUT

Exhibit 7
A PLANNING PATH



into the preparation of a development plan. However, this planning path shows other inter-relationships such as: (a) existing surrounding urban context, (b) existing inner-institutional context, (c) heritage context back-in-time, and (d) trends and changing patterns ahead-in-time. — *Ref. 14*

Technique No. 15

"DESIGN STUDY CHARTS"

A study program is organized, designed, and phased to make the investigation and prepare the program, keeping in mind the complexity of the project and its time schedule and budget. The chart in Exhibit 8 shows the phasing of a transportation study program which is similar to the study programs used in programming a building complex. The phases in the chart follow the normal development of a building program which is data collection, analysis, forecasting, plan development, and implementation. Such charting is used as the basic blue print (or master program plan) for carrying out the study. — *Ref. 15*

Technique No. 16

"PLANNING SYSTEM DIAGRAM"

Another example of the systematic approach to planning is shown in the Exhibit 9, "land use — transportation study planning system diagram." The importance of land use and transportation in almost any building project now makes it necessary for the architectural programmer to think comprehensively about the various input subjects and the sequence of planning a system. This diagram and the reference article describe a method of not only gathering the complex information but also analyzing the information for subsequent design. — *Ref. 16*

Technique No. 17

"STUDY ORGANIZATION CHART"

Program investigations, which are started early and extended over a long period of time, have changes in personnel and responsibilities. The changes in personnel are often forgotten. However, one firm maintains a "study organizational chart" as shown in Exhibit 10. The

Exhibit 8
DESIGN STUDY CHART

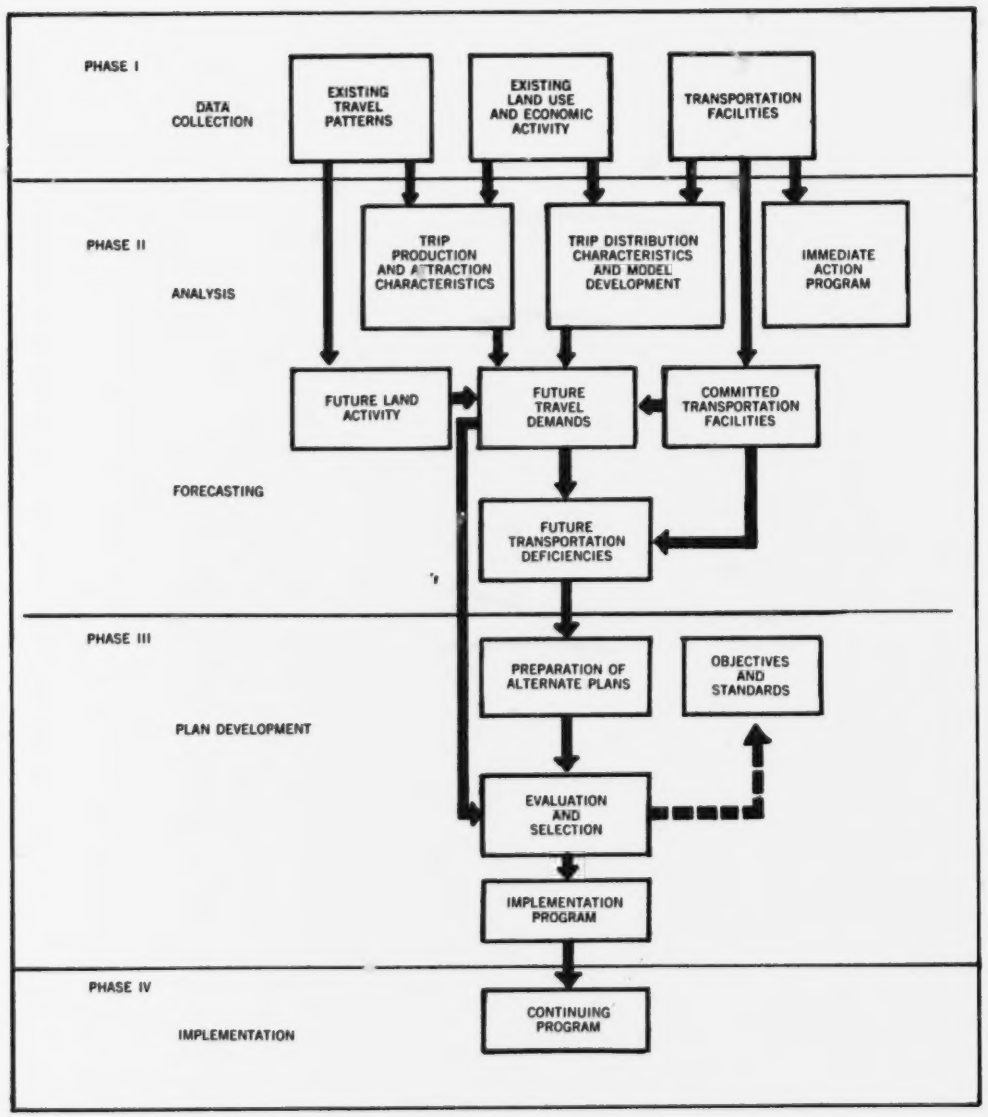


Exhibit 9
PLANNING SYSTEM DIAGRAM

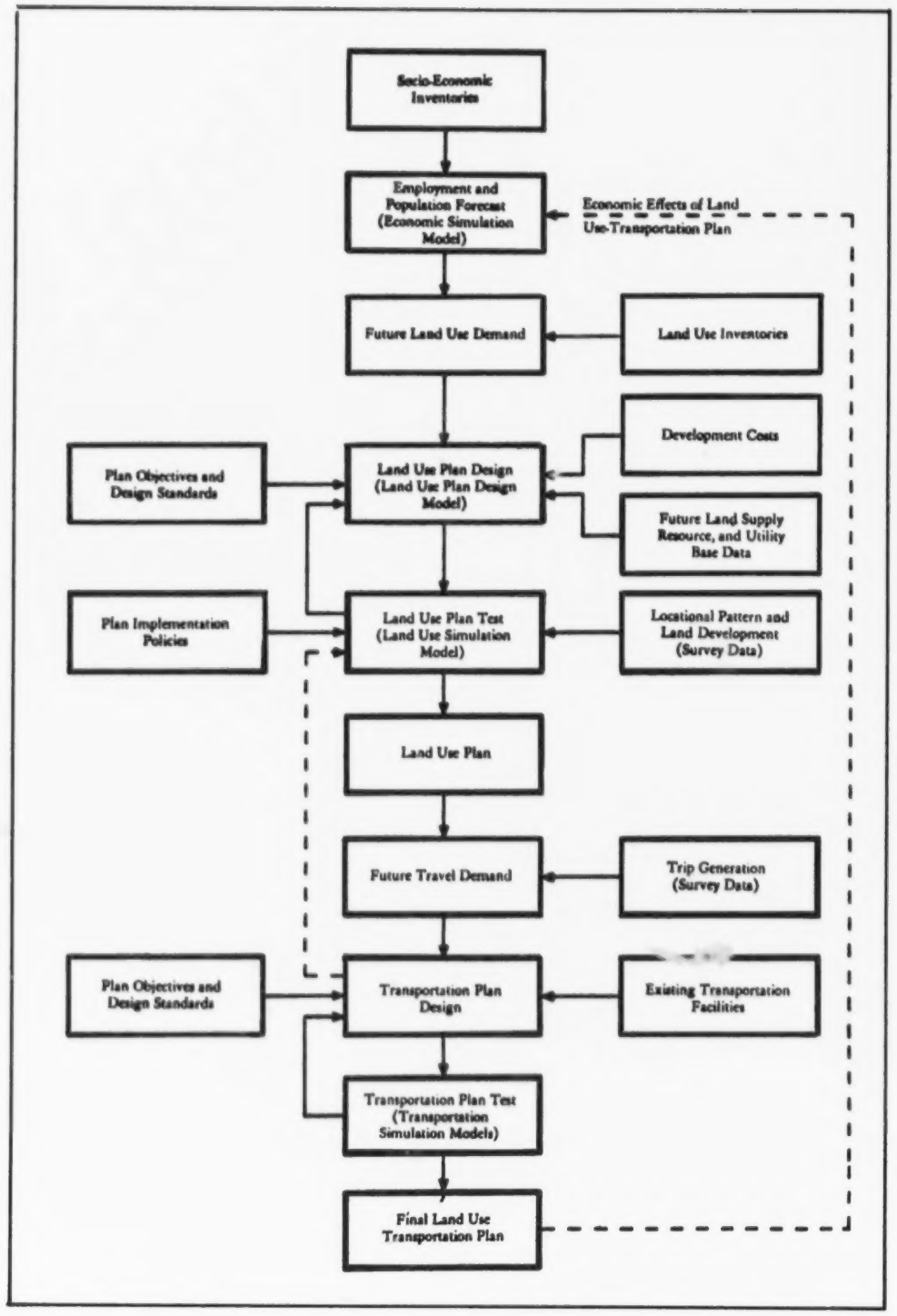
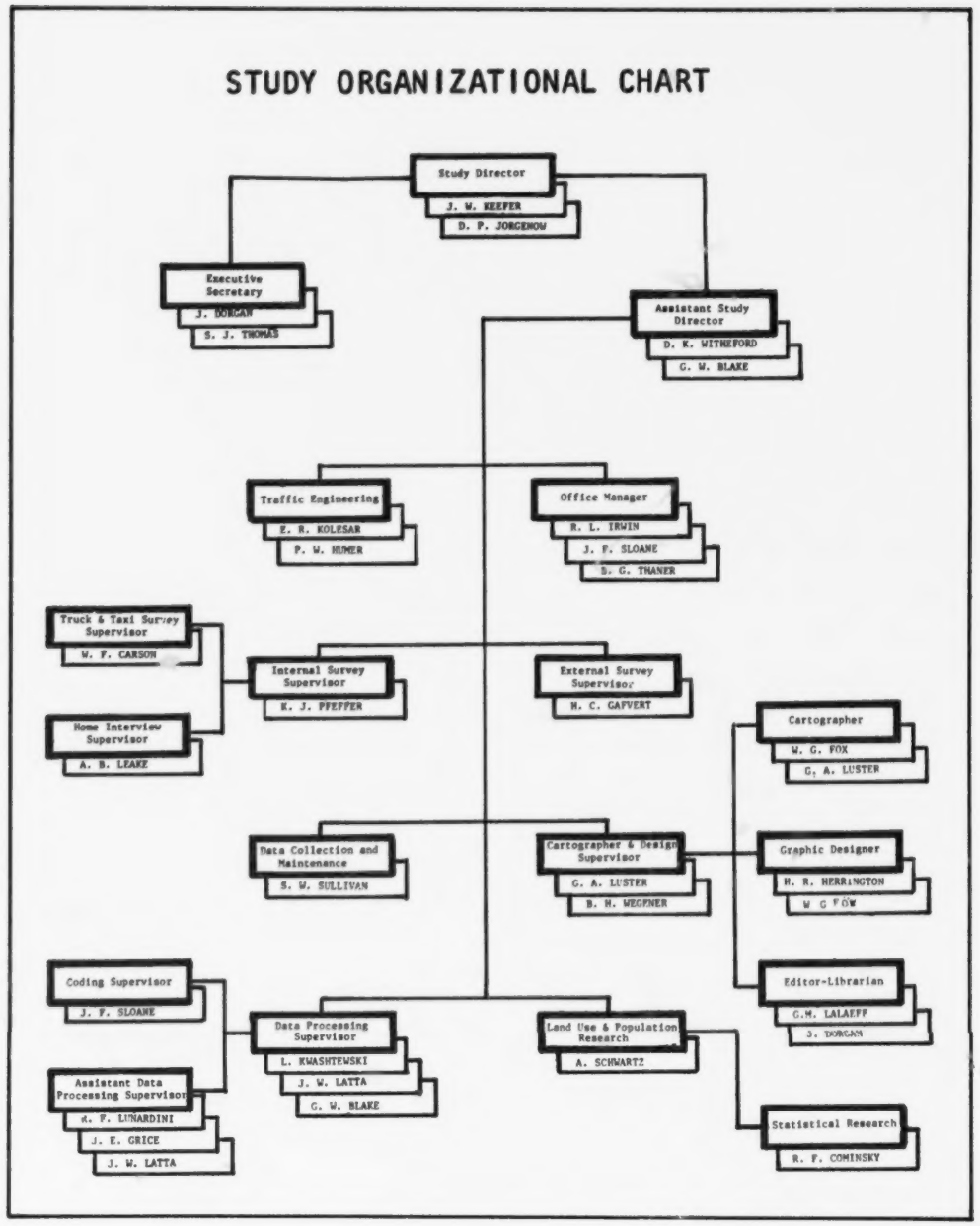


Exhibit 10
STUDY ORGANIZATIONAL CHART



study chart shows the changes of personnel and the periods of responsibility for each person on the study team. It was reported that more than 300 different people worked on the study at one time or another for the three-year period from the beginning to the end of the study. — *Ref. 17*

Group "D" Techniques

INVESTIGATIVE TECHNIQUES OF PROGRAMMING

Technique No. 18

"SPECIFIC ROOM DATA FORMS"

One architectural firm facilitates the conceptualization of room data and characteristics by means of a "Specific Room Data Form," shown in Exhibit 11. This form is used as a checklist in programming a single room or as a questionnaire for describing the characteristics of a room. The form helps the programmer to think about and put "capsule data" about one space on one sheet of paper. The data on the form is backed up with additional sheets showing sketches, diagrams, specific equipment data, details, and the like. The method assists in accumulating data on a single space in one spot.

Some architectural firms use multi-page forms for the assembly of data and one firm has developed a 16-page format for single rooms in such sophisticated rooms as chemical, biological, and other research laboratories. — *Ref. 18*

Technique No. 19

"ROOM REQUIREMENTS FORMAT"

It is not unusual for the creative architect to develop his own format which graphically shows room space requirements. Data is accumulated on forms which are distinctive to their own investigative procedures and analytical methods. One such room requirements format prepared by an architectural firm is shown in Exhibit 12. As in other formats, it provides space for various types of information which can be added from time to time to the investigation documents. Later it can be assembled into comprehensive charts for use in the design development. — *Ref. 19*

Exhibit 11
SPECIFIC ROOM DATA

CHRISTIE, NILES & ANDREWS — ARCHITECTS — JOB NO: 10

9. SPECIFIC ROOM DATA — TYPE: — NAME: — NO ROOM: SIM. NO: — DATE: LAST REV:

A. PURPOSE OF AREA	G. SERVICE TYPES	L. FLOOR FINISH	S. AIR
1. MAIN	1. MAIL	1. RESILIENT	1. TEMPERATURE
	2. SUPPLIES	2. CONDUCTIVE	2. HUMIDITY
	3. RECORDS	3. STAIN RESISTENT	3. SEP. THERMOSTAT
	4. TRASH REMOVAL	4. NON-SLIP	4. EXHAUST (NORMAL)
2. SECONDARY	5. FOOD	5.	5. EXHAUST SPECIAL
	6. LAUNDRY	M. BASE FINISH	6. ODOR CONTROL
3. HOURS OF USE	7. FLOWERS	1. SANITARY	7. CLEANLINESS
4. PEAK USE	8. SPECIAL EQUIP.	2. STAIN RESIST.	8. ULTRA-VIOLET
5.	9. ICE	3. HEIGHT	9. RADIATION CONTROL
	10. SPECIMENS	N. WALL FINISH	10.
B. PEOPLE	11. FILMS	1. WASHABLE	T. PLUMBING
1. MAXIMUM NO.	12.	2. SOUND DROP DB.	1. WATER — COLD
2. AVERAGE NO.	H. SERVICE METHODS	3. STAIN RESIST.	2. WATER — ICE
3. TYPES	1. PNEUMATIC TUBE	4.	3. WATER — HOT
4. MANAGEMENT	2. ELEVATOR	O. CEILING FINISH	4. DISTILLED WATER
5. EMPLOYEE	3. DUMBWAITER	1. ACOUSTICAL	5. SANITARY SEWER
6. MEMBERS	4. CONVEYOR	2. FLEXIBLE	6. SPECIAL LAB. DR.
7. VISITORS	5. CARTS	3. SOUND DROP DB.	7. STORM DRAIN
8. SERVICE	6. STRETCHERS	4. MOISTURE RESIST.	8. FLOOR DRAIN
9. PUBLIC	7. WHEELCHAIRS	5. MIN. CEILING HT.	9.
10.	8. PEOPLE	6.	U. PLUMBING FIXTURES
C. ACCESS	9.	P. LIGHT	1. DRINKING FOUNTAIN
1. NEAR PUBLIC ENT.	I. FURNITURE	1. DAYLIGHT	2. WATER COOLER
2. ON MAIN CIRC.	1. DESK.	2. SUNSHINE	3. LAVATORY
3. ON SECONDARY CIRC.	2. TABLE	3. SUN CONTROL	4. TOILET
4. OUTSIDE EXIT	3. CHAIRS	4. BEST EXPOSURE	5. URINAL MEN
5. NEAR SERVICE ENT.	4. SOFA	5. INCANDESCENT	6. URINAL WOMEN
6. NEAR PARKING	5. BOOK SHELVES	6. FLUORESCENT	7. SHOWER
7. EMERGENCY ENT.	6. BEDS	7. DRAMATIC	8. BATHTUB
8.	7. BUREAU	8. SUBDUED	9. SINK
D. SOUND	8. COAT RACK	9. NIGHT LIGHT	10. CLINIC SINK
1. NOISE GENERATION	9. DRAPERIES	10. FOOTCANDLES GEN.	11. SERVICE SINK
2. IN NOISY ZONE	10. RUGS	11. FOOTCANDLES	12. TOILET RM. ACCESS
3. IN MODERATE ZONE	11. SCULPTURE	12. REFLECTION FACTORS	13.
4. IN QUIET ZONE	12. PICTURES	13. MAX. BRIGHTNESS	V. MECHANICAL SERVICES
5. ISOLATE	13. CLOCK, ELEC.	14. COLOR CORRECT	1. STEAM
6. FOR SPEECH	14. DISPLAY AREA	15. EMERGENCY	2. COMPRESSED AIR
7. FOR MUSIC	15. BULLETIN BOARD	Q. POWER ELECTRIC	3. VACUUM
8.	16.	1. NUMBER OF OUTLETS	4. GAS COMMERCIAL
E. CONTROL	J. EQUIPMENT	2. VOLTAGE	5. VACUUM CLEAN
1. SECURITY	1. TYPEWRITER	3. CONTROL IN ROOM	6. OXYGEN
2. VISUAL	2. ADDING MACHINE	4. EXPLOSION PROOF	7.
3. ISOLATE	3. DUPLICATING EQUIP.	5. WEATHER PROOF	W. FIRE PROTECTION
4.	4. IBM RECORDS	6. EMERGENCY	1. COMB. CONTENTS
F. EXPRESSION OF SPACE	5. FILES LETTER SIZE	7.	2. SPRINKLERS
1. FORMAL	6. FILES LEGAL SIZE	R. COMMUNICATIONS	3. STANDPIPE
2. DIGNIFIED	7. FILES SPECIAL	1. FIRE ALARM	4. PORTABLE EXTING.
3. QUIETNESS	8. STERILIZER	2. A.D.T.	5.
4. ORNAMENTAL	9. HOOD	3. EMERGENCY LIGHTS	X. STRUCTURES
5. PURPOSEFULNESS	10. REFRIGERATOR	4. TELEPHONE	1. LIVE LOAD
6. SENTIMENTAL	11. FREEZER	5. INTERCOM.	2. VIBRATION ISSOL.
7. WARM	12. INCERATOR	6. PAGING SYSTEM	3.
8. OPENNESS	13.	7. PUBLIC ADDRESS	Y. CONTROL DIMENSIONS
9. ACTIVENESS	K. STORAGE	8. TELAUTOGRAPH	1. REASON
10. EXCITEMENT	1. LOCKERS	9. MUSIC	2. LENGTH
11. TEXTURAL	2. SIZE	10. T.V. CLOSED CKT.	3. WIDTH
12. EFFICIENT	3. STORAGE UNITS	11. T.V. (NORMAL)	Z. AREA OF SPACE
13. FUNCTIONAL	4. BASE LIN. FT.	12. T.V. AERIAL	1. ASSUMED
14. UTILITARIAN	5. WALL LIN. FT.	13. RADIO AERIAL	2. DESIGN MIN.
15.	6. SPECIAL CABINETS	14.	3. ACTUAL

Exhibit 12
ROOM REQUIREMENTS FORMAT

ROOM REQUIREMENTS

REHABILITATION INSTITUTE CHICAGO ILL
C F MURPHY ASSOC CHICAGO ILL

DEPARTMENT PHYSICAL THERAPY SCHOOL (N.O.)

SCHOOL DIRECTOR'S OFFICE

CODE **10**

FURNITURE — EQUIPMENT

FURNITURE

DESK W/CHAIR
CONFERENCE TABLE (1)
SIDE CHAIRS (6)
BOOKSHELVES 15 L./FT.

EQUIPMENT

FILE DRAWERS 15" X 30"

MECHANICAL

HEATING, VENT., AIR COND.

special

PLUMBING

special

COMMUNICATIONS

TELEPHONE
DICTAPHONE

ELECTRICAL

receptacles _____
special loads _____
other _____

ARCHITECTURAL

FLOORS

CARPETING
special

WALLS PARTITIONS

special

CEILINGS

special

DOORS WINDOWS

special

ACOUSTICAL

special

RELATIONSHIP TO OTHER SPACES

PRIMARY

MEDICAL DIRECTOR'S OFFICE
ASSISTANT DIRECTOR'S OFFICE

SECONDARY

REMARKS

NUMBER PEOPLE
staff 1 male
_____ female
patients _____

DIMENSIONS
15' x 15'
area 225 s.f.

NO. ROOMS REQUIRED
1
total 225 s.f.

EXISTING AREA
total _____ s.f.

OTHER

Exhibit 13
EQUIPMENT & SERVICES CHART

Chemistry Section				
Room	**Utilities**	**Services**	**Furniture**	**Equipment**
General Lab.	220V Single Phase 110V Plugmold 6 circuits at 20 amps Compressed Air Gas Vacuum Cold water Hot water	Floor Drain Overhead Shower	Lab Benches (100 ft.) Desks (2) Wall Cabinets (40 ft.) Weighing Table File Cabinets (2)	Refrigerator Freezer Dishwasher Ultrasonic cleaner Water Still Spectrophotometer Autoanalyzer Gas Chromatograph Atomic Absorption Wall oven Sinks (2) Fume Hood
Weighing Room	110V Plugmold		Balance tables (3) Lab Benches (15 ft.)	Analytical Balance (2) Micro Balance Macro Balance
Chromatography Room	110V Plugmold Hot water Cold water Gas Compressed Air Vacuum	Floor Drain Overhead Shower Exhaust Vent	Lab Benches (25 ft.) Tables (2) Desk Wall Cabinets (20 ft.)	Sink Fume Hood Hot Plates Drying Oven Flame Photometer

Technique No. 20

"EQUIPMENT AND SERVICES CHART"

In the early stages of investigating the needs of science laboratories and sophisticated spaces, it is impotrant to foresee the technical requirements such as utilities, services, furniture, and equipment. One architect uses a columnar chart as shown in Exhibit 13 to list such needs. The technique is also used by clients to identify technologically and functionally a space in such a way as to permit the conceptual programmer to understand the space design requirements without attempting to direct the space layout. — *Ref. 20*

Technique No. 21

"STANDARD ROOM REQUIREMENTS FORM"

Another type of room requirement form, developed by an architect's consultant, is shown in Exhibit 14. The form is designed to allow space for project and room identification and square footage. It also describes the occupancy and lists equipment. It has a checklist for the investigator to check-off room finish characteristics and such other services as communication, lighting, power, mechanical services, gases, plumbing, and so on.

The important aspect of this technique is that by standardization of form the investigator can assemble information quickly. He can add information from time to time and, subsequently, he can analyze and synthesize the data for the purpose of presentation. — *Ref. 21*

Technique No. 22

"SPACE CRITERIA SHEETS"

The increasing complexity of environmental space requirements makes it important for architectural programmers to define accurately the environmental requirements within certain spaces such as laboratories, studios, kitchens, hospital spaces, storage spaces, and so on. One form, which has been developed for architect's and engineer's use, is shown in Exhibit 15. This form names the various rooms or spaces which have a common air environment and then shows a format for declaring the desired air temperature, relative humidity, air velocity, amount of fresh, outdoor air, and desired pressure within that type of space. — *Ref. 22*

Exhibit 14
STANDARD ROOM REQUIREMENTS FORM

SURGERY SUITE

Operating Rooms 1 @ 572, 1 @ 405, 5 @ 360

Programmed Area (Net) 2,777 Sq. Ft.

EXIST | OFOI | OFCI | OFCI

OCCUPANCY: Patient + Five to Six Staff

EQUIPMENT:

1—Table, major operating (84" x 20")
1—Table, instrument (24" x 48")
1—Table, mayo (13" x 20")
2—Stands, basin—single (16" x 14")
1—Stand, basin—double (28" x 14")
3—Buckets, kick (13" diameter)
1—Stool, foot (30" x 12")
3—Stools, foot (16" x 12")
1—Stool, anesthetist's (14" x 15")
3—Stools, operator (14" diameter)
1—Machine, anesthesia (46" x 27")
1—Cabinet, anasthetist (36" x 24") portable
1—Table, anesthetist (20" x 16")
1—Hamper, linen (24"Δ)
1—View box (double, recessed)
2—I.V. stands

CEILING
- Acoustical
- Plaster
- Exposed
- Keene's Cement Plas.
- ✓ Vinyl on Drywall

WALLS
- Plaster
- Exposed
- Matte-glazed Tile
- ✓ Keene's Cement Plas.
- Vinyl on Drywall

WAINSCOT
- Vinyl
- Matte-glazed Tile
- Glazed Structural Units

BASE
- ✓ Matte-glazed Tile
- Glazed Structural Units
- Rubber

FLOOR
- Floor Loads (lbs./sq. ft.)
- Asphalt Tile
- ✓ Vinyl Asbestos Tile
- ✓ Ceramic Tile
- Conductive Floor
- Vinyl

COMMUNICATION
- ✓ Telephone
- Intercom. System
- Paging System
- Radio & Public Address
- ✓ Nurse Call System
- Emergency Nurse Call
- Central Dictating Sys.

LIGHTING
- 100 Foot Candles at Task
- ✓ Emergency
- Special (See Equip.)

ELECTRICAL
- ✓ Emergency
- ✓ X-Ray Outlet
- Clock 8"

MECHANICAL
- ✓ Air Changes/hr.
- 100% Exhaust
- Room Pressure
- ✓ Special Ventilation
- Humidity
- ✓ Exhaust Hood

PIPED GASES
- Oxygen—O_2
- Nitrous Oxide—N_2O
- Clinical Gas—Heat
- Vacuum
- Compressed Air

Date:

PLUMBING
- Water Closet w/diverter
- Urinal
- Shower
- Bath Tub
- Sitz Bath
- Lavatory
- Counter Sink
- Clinical Sink
- Service Sink
- Drinking Fountain
- Floor Drain
- Plaster Trap
- Disposer
- Acid Considerations
- Steam

DOOR
- 42 Wide x 7' High

Appr. by

Architect:

MEDICAL PLANNING ASSOCIATES

Exhibit 15
SPACE CRITERIA SHEETS

Space criteria sheet no. 31

INSTRUCTIONAL - SUPPORTING FACILITIES

AUDIO-VISUAL

Storage
- Equipment & Materials Room
- File Room
- Monitor Room
- Preview Room

PHYSICAL TRAINING

Storage

STUDIOS

Storage

LABORATORIES

Storage *

C R I T E R I A

1. Air temperature: 75° F
2. Relative humidity:
   a. Cooling: 40-50%
   b. Heating: 20% minimum
3. Air temperature on occupants:
   a. Cooling: No more than 7 F° below room temperature.
   b. Heating: No more than 4 F° above room temperature.
4. Air velocity on occupants, maximum:
   a. Cooling:

temp diff: F°	-7	-6	-5	-4	-3	-2	-1	0	+1
at neck: fpm	x	x	x	0	10	25	40	60	85
at ankles: fpm	5	15	25	37	53	74	100	x	x

   b. Heating:

temp diff: F°	0	1	2	3	4
air velocity: fpm	30	45	60	75	90

5. Fresh outdoor air: From a minimum of 0.2 to a maximum of 1.0 cfm per sq ft of floor area depending on the materials to be stored. In case of doubt, consult manufacturer for his recommendations. If people regularly use these spaces for any length of time, use the above criterion or the following, whichever is higher.

air space: cu ft/person	100	200	300	400	500	600	700	800
fresh air: cfm/person	24	18	12	9	7	6	5	5

6. Pressure: Atmospheric

* In some spaces of this category, the pressure (item 6) should be negative because of the type of material stored. In such cases, air should be exhausted directly to outdoors and should not be recirculated.

Technique No. 23

"EQUIPMENT AND CASE WORK CHECKLIST"

Competency in architectural programming shows up in the understanding of the user's equipment and furnishings. Even though the functional equipment in many architectural building types may be considered secondary to other aspects of conceptual space planning, it is of vital importance in the investigation of needs in the field of scientific laboratories, hospitals, and sophisticated spaces.

The expert programmer investigates the functional equipment and services because they help to shape the space layouts and the service systems. But, of primary importance is the fact that through equipment a mutual respect and communications link can be established between architectural programmer and client's representatives. One architectural firm uses a technique of listing equipment and casework in various spaces and then uses the list as a checklist for showing the plumbing connections, hood and oven requirements, as shown in Exhibit 16. — *Ref. 23*

Technique No. 24

"BUILDING HISTORY INVESTIGATIONS"

Since architectural services are required in many cases to add new buildings or extend old buildings on existing sites, it is important for the architectural programmer to be well-versed on the history of the client's organization and his existing buildings. It is often wise to be familiar with the experiences which the client has had in developing his existing buildings.

For this reason, the architectural programmer delves into such histories in order to be in a position to converse intelligently with the client's representatives. Re-creating a previous architectural error which the client has experienced is unpardonable and one of the techniques used by contemporary architectural programmers is to investigate the client's occupancy problems. The re-creation of the history of the organization's use of a building does not necessarily need to be documented, but it should be documented if it is found to be of specific importance to the client and, later on, to the designers. Such importance may be noted in a list of "do's and don'ts" which would have a great deal of meaning to the proposed occupants and users of the new building. — *Ref. 24*

Exhibit 16
EQUIPMENT CHECKLIST

	PLUMBING	HOOD	OVEN
PAINT LAB			
1. WORK TABLE			
2. SINK CABINET	•		
3. CORNER SINK	•		
4. FUME HOOD — INDUCED AIR		•	
5. FUME HOOD — BASE		•	
6. COUNTER DRAWER			
7. MULTI-DRAWER FAUCET			
8. DRAWER CUPBOARD CABINET			
9. DRAWER CUPBOARD CABINET			
10. END FILLER PANEL			
11. END FILLER PANEL			
12. WALK-IN PAINT SPRAY HOOD		•	
13. REAGENT SHELF			
CHEM. LAB.			
1. FLOOR CASE, STEEL DOORS			
2. FLOOR CASE, GLASS DOORS			
3. COUNTER DRAWER			
4. BRINKMAN BALANCE TABLE			
5. WALL CASE, GLASS DOORS			
6. DRAWER UNIT			
7. CORNER COUNTER SINK	•		
8. COUNTER UNIT, FIT			
9. FILLER PANEL FOR D-24			
10. FILER PANEL FOR D-47			
11. FILLER PANEL FOR D-24			
12. FILLER PANEL FOR CO 24			
13. FUME HOOD BASE		•	
14. FUME HOOD BASE		•	
15. PETROLITH FUME HOOD			
16. EPOXY SINK, IN FUME HOOD			
17. FUME HOOD, INDUCED AIR			
18. CORNER CABINET			
19. CUPBOARD DRAWER CABINET			
20. MULTI-DRAWER CABINET			
21. CLEAN UP SINK	•		
22. DRAWER UNIT			
23. END PANELS			
24. END PANELS			
25. END PANELS			
26. END PANELS			
27. TENSIOMETER			
28. REAGENT SHELF			
MACHINE ROOM			
1. TINIUS OLSEN MACHINE			
2. TESTING MACHINE (300,000 LB. TEST)			
3. WORK BENCH			
4. CABINET STORAGE			
5. CABLE EPOXYING BENCH			
6. SAND BOX			
7. CABLE OVEN			
MISC. SAMPLES			
1. FREEZER			
2. TENSIOMETER			
3. WEATHEROMETER			

	PLUMBING	HOOD	OVEN
ASPHALT MIX DESIGN & CONTROL			
1. DESK & FILE CABINET			
2. AGGREGATE STORAGE			
3. SCREENS & SAMPLES			
4. ROTAPS		•	
5. CLASSIFY			
6. COMBINE			
7. OVEN 275°			•
8. BALANCE			
9. WEATHER & MIX			
10. TABLE			
11. COMPACTOR			
12. STABILOMETER			
13. MOLD OVEN, VENTED			•
14. CLEAN UP, WITH HOOD		•	
15. OVEN 140°			•
16. SAMPLES IN			
17. HEAT 275°		•	•
18. WEIGHT			
19. PREPARE MIX			
20. RICE RADC			
21. SINK AND ASPIRATOR BANK	•		
22. 77° BATH	•		
23. WASTE	•		
24. 140° BATH MC			
EXTRACTION			
1. OVEN, VENTED			•
2. EXTRACTION UNITS, W/HOOD		•	
3. IR DRIERS, W/HOOD		•	
4. STILL & WASTE W/HOOD	•	•	
5. BALANCE W/HOOD		•	
6. 77° BATH & SINK ASPIRATOR, W	•	•	
7. ROTAP			
8. SCALE OUT			
9. SAMPLES IN — WORK BENCH			
CORES			
1. OVEN 275°			•
2. WORK SPACE			
3. SP. GR. — BALANCE, WATER BATH	•		
4. DIAMOND SAW			
5. CLEAN UP W/HOOD		•	
6. STORAGE			
7. TABLE			
8. REFRIGERATOR			
PHOTOMETRIC LAB.			
1. CORNER CUPBOARD			
2. FUME HOOD — INDUCED AIR		•	
3. FUME HOOD, BASE, WITH SINK	•	•	
4. DRAWER CABINET			
5. DRAWER CUPBOARD CABINET			
6. COUNTER CUPBOARD CABINET			
7. COUNTER DRAINER UNIT			
8. FLOOR CASE			
9. END PANEL			
10. CORNER SINK CUPBOARD	•		

Technique No. 25

"PROGRAMMING QUESTIONNAIRE FORMAT"

Architecturally prepared questionnaires can be creatively and expertly designed to secure pertinent information from the client and his representatives. The instructions request the person filling in answers or providing data to give careful consideration to questions so that "a proper evaluation of the special needs of the proposed environment may be determined."

One extensive questionnaire used by an architectural firm is divided into four parts. It is often filled in by different persons at different times and is described as follows:

Part one, involves a five-page questionnaire on general subjects and information for master planning. These subjects are: (a) acoustical considerations, (b) audio-visual and communications, (c) built-in-furniture, (d) electrical, (e) plumbing, (f) heating and ventilating, (g) health and safety, (h) structural. The form has space to provide statistical data on the person who fills in the questionnaires as well as space for approval by his various superiors, thus emphasizing the source of data and the reliability of the source.

Part two solicits information on the three groups of building equipment required in a typical building as follows:

Group 1 — contractor-purchased, -installed, and -connected equipment, including monorail hoists, hoods over heat producing equipment, sinks, and so on.

Group 2 — owner-purchased, -installed, and -connected equipment, such as shop machines, kitchen ranges, electric typewriters, hot plates, refrigerators, and so on.

Group 3 — owner-purchased, owner-installed, but without connection to building utilities, such as manual typewriters, storage units, furniture, and so on. This type of equipment questionnaire is designed to make people think more realistically about their mode of operation and equipment requirements, especially those which require space and service connections.

Part three is designed to secure information about existing support facilities which would be modified, relocated, or provided, such as athletic areas, maintenance areas, student or faculty

courts, social areas, swimming pools, and so on. This questionnaire is intended to pick up information which usually does not come out at the start of the investigation. It is also intended to seek facilities which do not come under the requirements of a single department.

Part four is a recapitulation sheet for architectural specifications and a room summary. This form calls for the preparation and presentation of an orderly set of room spaces showing quantities and types by area groups and/or departments. *Ref. 25*

Technique No. 26

"PROGRAM REQUIREMENTS BOOKLET"

One architectural firm uses a technique for soliciting all of the client's information from a single, key individual in a client's organization. It is understood that that person will secure the opinions of all users concerned and make up a "consensus of opinions and requirements." Such a 66-page Program Requirements Booklet is described here.

The client's representative uses the booklet which is set up as: (a) a series of questions and (b) a checklist of items as follows:

(a) items pertaining to philosophy and policies are secured from the top directors,
(b) questions pertaining to department functions, equipment, and spaces are handled by department heads, and
(c) common areas, site planning, and general facilities are handled by those most concerned or most knowledgeable.

The summation of this information is then recorded and kept in the program requirements booklet which ultimately becomes the client's program statement-in-total for the project. — *Ref. 26*

Technique No. 27

"ARCHITECT'S PRESENTATION OF QUESTIONS"

A technique developed by one architectural firm involves the use of a program kick-off meeting at which time the architect presents by projector or cards the important questions which must be answered during the programming phase in order to arrive at a desirable solution to the problem. Show cards are made up ahead of time and have such questions as:

- how many occupants in various spaces?
- percentage and ratio of various groups,
- schedules of events for typical 24-hour days,
- relationship of people (groupings, team, relationship),
- facility requirements, philosophy of services, individual or team efforts, administrative procedures, relationship of research to operations, staff make-up, functional performance, ultimate services desired, common denominators, major elements, social mix areas, visual and physical control requirement, and other questions.

The joint meeting with client and architect representatives focuses attention on the important questions, demonstrates the team responsibility of architect and client representatives, and permits the architect to lead the client into logical sequences of programming and new approaches or solutions. — *Ref. 27*

Technique No. 28

"SPACE-TIME LOG"

Another technique used by a team of researchers involves the acquisition of a great deal of information about the movement patterns and functioning of people within areas. In this case the area was the core of a major city. The team, composed of architects and planners, developed a "space-time log" in the form of a booklet, a page of which is shown in Exhibit 17. The exhibit is a photocopy of the page of instructions which accompanied the weekly log booklet. The booklet was used by individuals to record their movements and activities, such as:

- going into the core area,
- activities within the core area, and
- traveling from the core area.

Information about the morning commuting hour, the middle of the day, and evening commuting hours was secured and later analyzed.

The booklet log was made up so that each person who cooperated in the survey on a sampling basis could record his movement and activity patterns for an entire week. The person was encouraged to state whether it was a typical work week or not. All of the logs of the sample were recapped or summarized to determine the activity patterns in different parts of the core area.

Exhibit 17
SPACE-TIME LOG

SPACE-TIME LOG INSTRUCTIONS

1. On bound-in instruction guide sheet please indicate:
   a) your name
   b) street address of your place of employment
   c) street address (or block address) of residence
      i.e. 936 38th Ave. N.
      900 block 38th Ave. N.
   d) name of cross streets along route to work that best define for you: edge of your residential area
      edge of the downtown area.

2. The scale used for this log establishes five minutes as the smallest unit of time to be recorded. If the time spent in a particular activity area (store) or at a particular activity (riding bus) is less than five minutes it need not be shown. A walk of two blocks or less would then not be shown (as is less than five minutes).

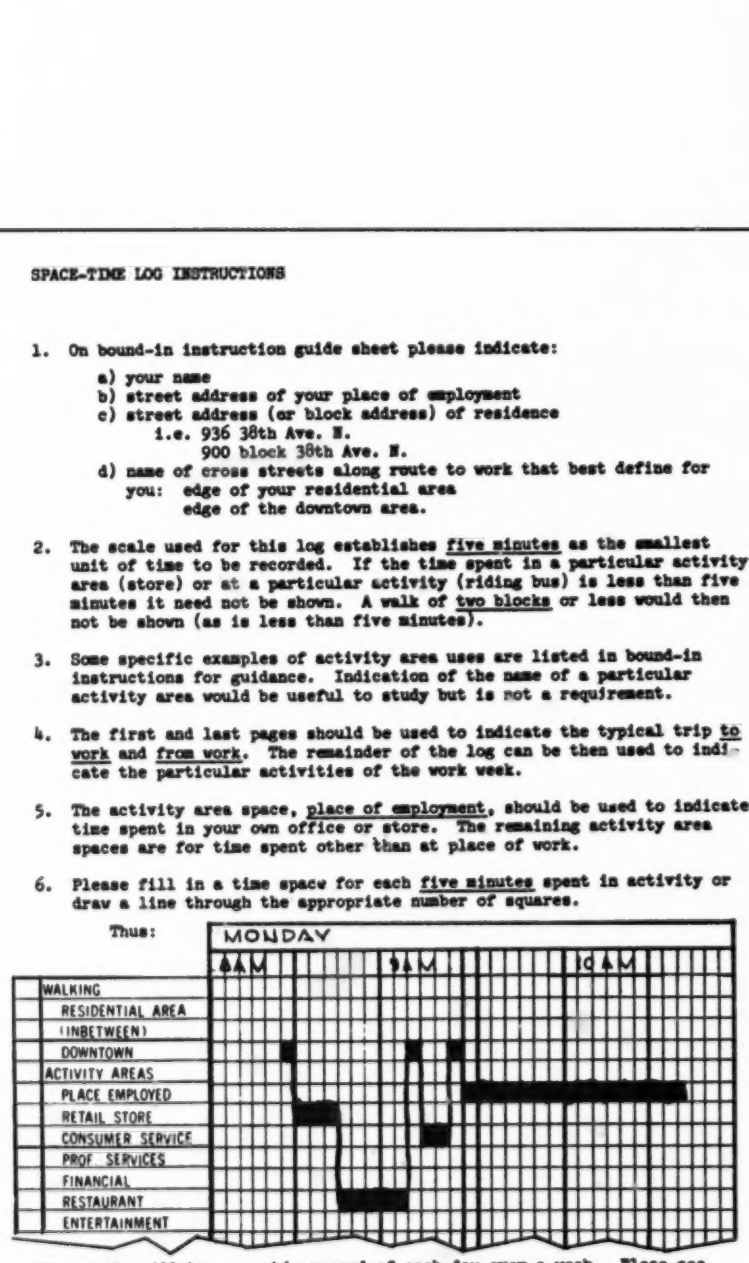
3. Some specific examples of activity area uses are listed in bound-in instructions for guidance. Indication of the name of a particular activity area would be useful to study but is not a requirement.

4. The first and last pages should be used to indicate the typical trip to work and from work. The remainder of the log can be then used to indicate the particular activities of the work week.

5. The activity area space, place of employment, should be used to indicate time spent in your own office or store. The remaining activity area spaces are for time spent other than at place of work.

6. Please fill in a time space for each five minutes spent in activity or draw a line through the appropriate number of squares.

Thus:



The result will be a graphic record of each day over a week. Plese see last page of bound-in guide for comment after completion of log.

Thank you.

Exhibit 18
TRACKING STUDIES

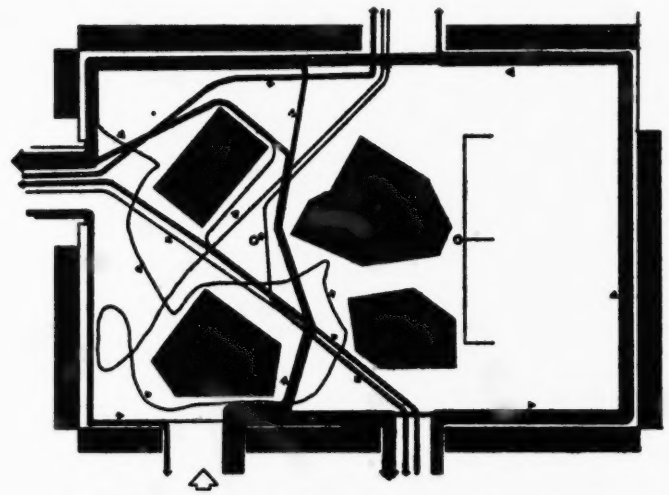


Figure 21 (Sunday, left turners, museum sample)

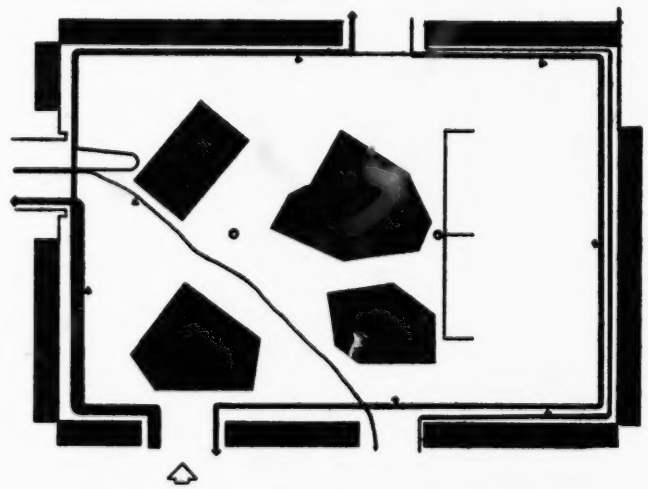


Figure 22 (Sunday, right turners, museum sample)

The technique is an example of fact finding which attempts to reconstruct a model of the human activities within an existing area. The log was one of several techniques — including short- and long-term tracking, questionnaires, and depth interviews — used to determine and correlate activity patterns and attitudes of users of the core area.

Extensive time-motion studies are not necessarily a function of the programmer. However, he often is required to design such investigations in order to obtain a good program which may be based on actual people, problems, and conditions rather than on casual observations. — *Ref. 28*

Technique No. 29

"TRACKING STUDIES"

Another technique which has been developed by behavioral scientists consists of tracking studies to discover the behavior patterns of people in stores, museums, and like spaces which have exits, entrances, displays, and other influences on personal movement. The programmer on projects which involve movement can make studies to determine traffic patterns around furniture, equipment, and exits.

An example of a study of traffic patterns is shown in Exhibit 18. The exhibit shows the super-imposition of various types of traffic patterns within single spaces. By tracking or tracing the movement of people over a period of time, an overlay is developed which graphically illustrates a set of desired line circulation patterns. — *Ref. 29*

Technique No. 30

"LINKS RELATED TO METHODS OF COMMUNICATION"

Because of the strong reliance on communications systems in everyday life and business, one architectural programmer has a technique for determining the methods of communication which are desirable for various departments, groups, or individuals within the building complex, as shown on "Communications Link Format," Exhibit 19. Individuals are polled as to the methods of communication which they desire. The methods range from "face to face" to "phone" to "delivery" and others. — *Ref. 30*

Exhibit 19
COMMUNICATION LINK FORMAT

D. Links to Related Activities and Methods of Communication

Activities	Methods of Communication				
	Face to Face	Phone	Delivery of Reports	Other	None
Importer-Exporter Firms		✓			
Foreign Consulates		✓			
Steamship Companies & Agencies			✓		
Freight Forwarders & Custom House Brokers	✓				
Air Freight Forwarders		✓			
Port of Seattle Offices	✓				
Financial Institutions		✓			
U. S. Customs Office					✓
Post Office				✓	
Railway Express					✓
Airline Agencies		✓			
Travel Agencies					✓
Others (Specify)					

Indicate whether a primary (1) or secondary (2) contact.

Interviewer Interviewee

Exhibit 20
POPULATION TREND PROJECTIONS

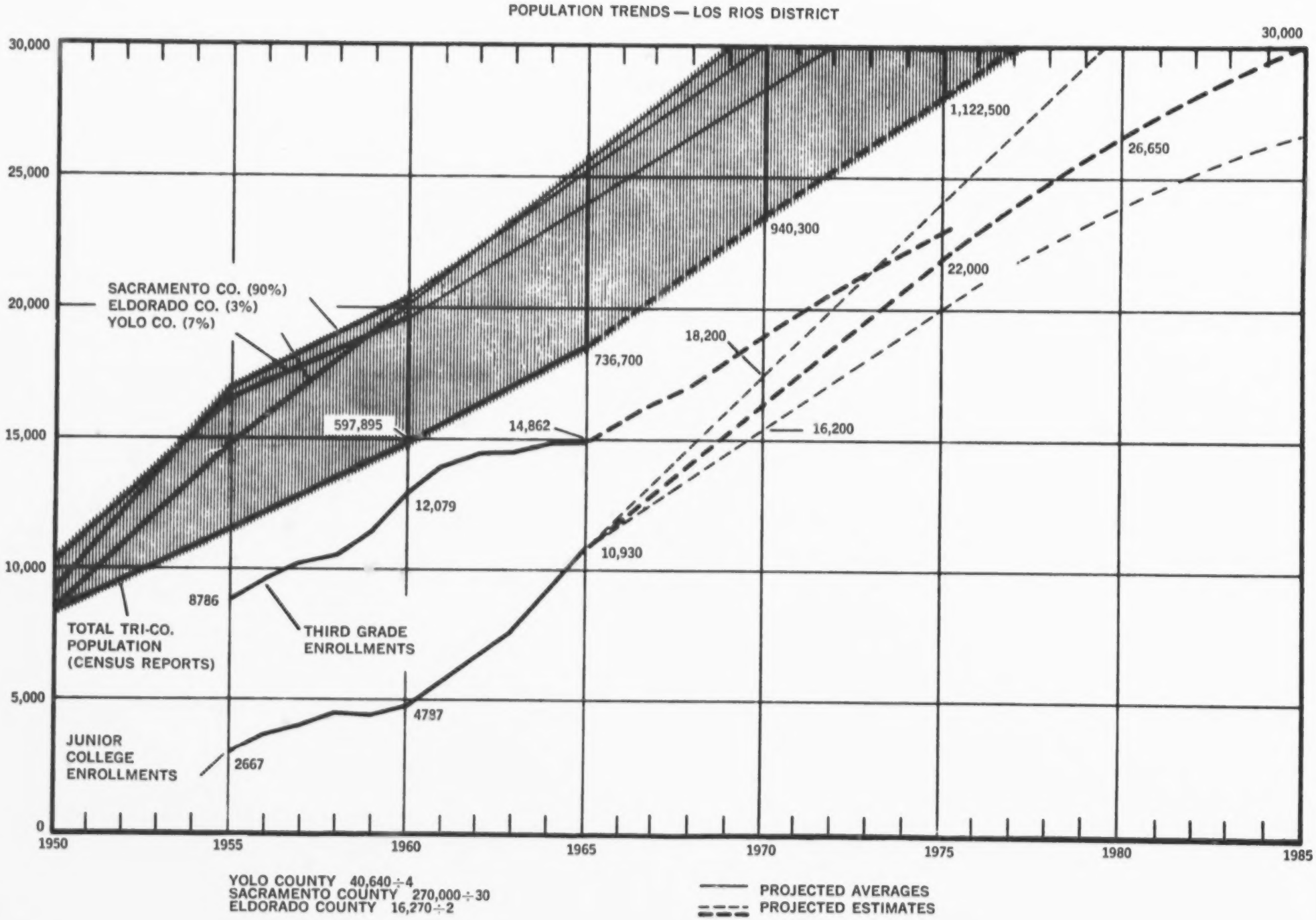
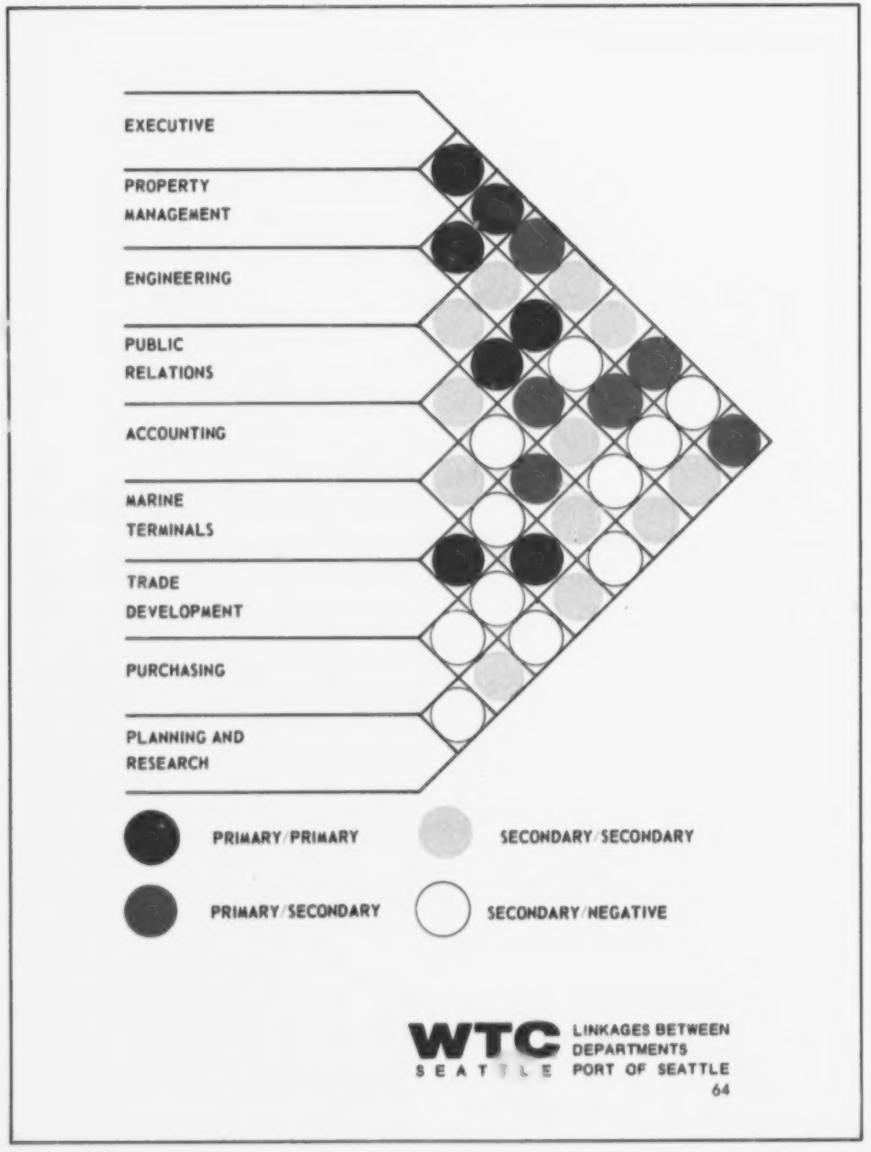


Exhibit 21
DEPARTMENTAL LINKAGES



Technique No. 31

"ULTIMATE LAND USE INVESTIGATIONS"

Architectural programmers who are given a selected site are faced with a different type of approach which starts with a pre-planning investigation of the site potential. Such an approach requires expert talent and consultation in the field of land use.

One architect-engineer firm, typical of many others, prepares a complete conceptual study on "ultimate land use" for the site. The investigative techniques required make it necessary for the programmer to consider and study zoning plans, building density plans, peak hour traffic studies, utilities plans, and so on. Extensive economic feasibility studies and justification studies are required as a prelude to the actual program preparation. — *Ref. 31*

Technique No. 32

"POPULATION TREND INVESTIGATIONS"

Program specialists investigate thoroughly the population trends, especially in the field of schools, stores, and community-type buildings which serve the population as a whole. One example of a population investigation is shown in Exhibit 20. The chart, "Population Trend Predictions," not only records the trends of the past and the immediate future, but also the long-range, projected averages and estimates. Admittedly, projections vary a great deal. But, in many respects, they can be averaged and estimated by a carefully prepared set of factors which is based on new births, new homes, utility expansion, transportation expansion, and so on. — *Ref. 32*

Group "E" Techniques

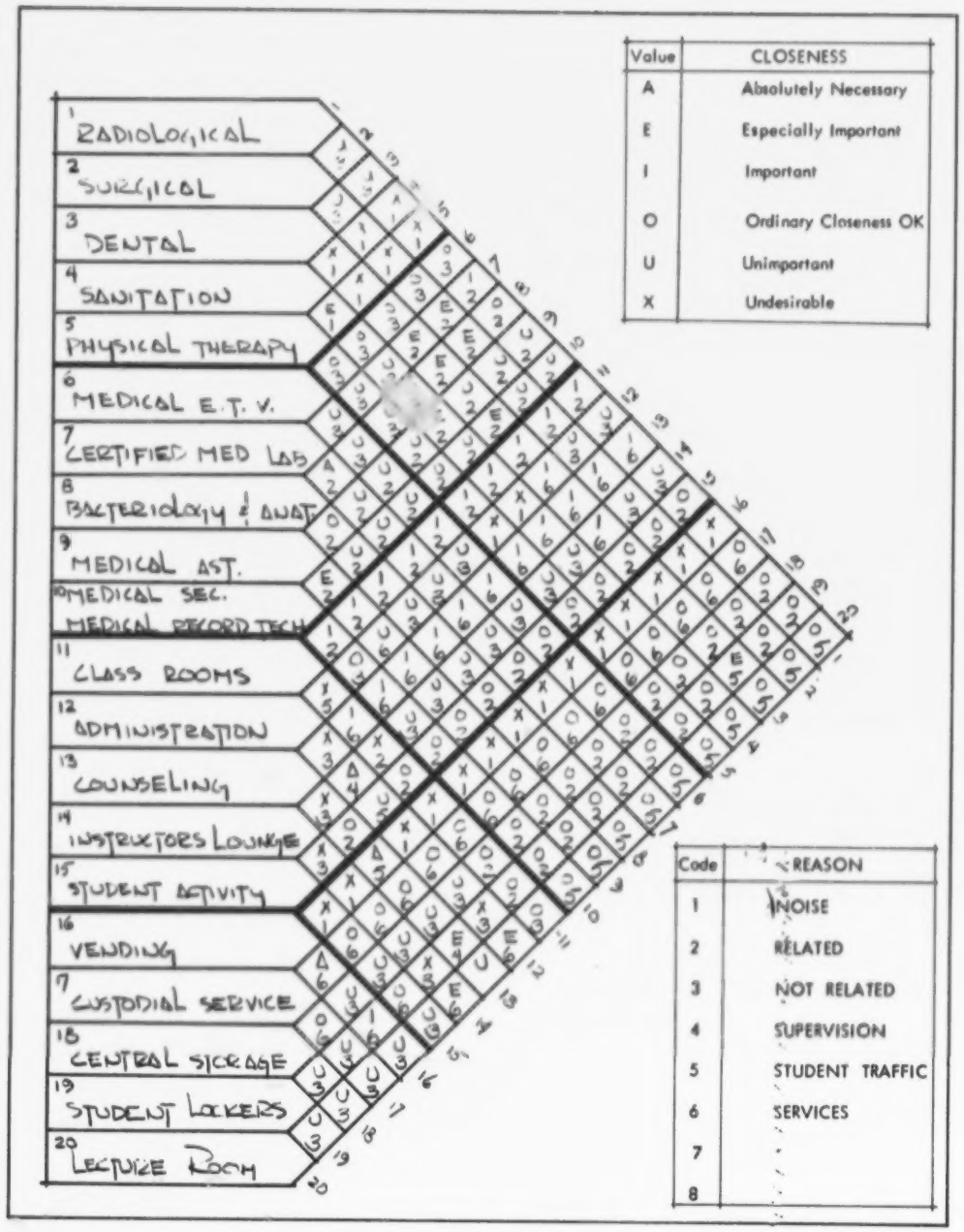
ANALYTICAL TECHNIQUES OF PROGRAMMING

Technique No. 33

"DEPARTMENTAL LINKAGES"

One technique for graphically showing linkages between departments of a building complex is shown in Exhibit 21. In this exhibit, each linkage is identified as a dual value judgment by circles of different shading. The blackest circle indicates that one department

Exhibit 22
ROOM RELATIONSHIP MATRIX



considers it has a primary linkage with another department and the other department also considers it has a primary linkage with the first department. The investigator determines the opinion of occupants with regard to relationships with other departments and then shows the relationship by shading of the circle.

This technique brings to mind the story of such an investigation among hospital department heads. The results of the opinion survey showed that the psychiatric department head felt that he had a strong relationship with all other department heads; yet, all other department heads stated that they had no relationship with the psychiatric department head. — *Ref. 33*

Technique No. 34

"ROOM RELATIONSHIP MATRIX FOR CLOSENESS AND REASON"

Architectural firms have expanded the linkage diagram shown above into a "room relationship matrix" or chart which is shown in Exhibit 22. The chart not only shows a relationship between two rooms or spaces, but it also attempts to establish a value system for the closeness of the two spaces and then adds a numerical coding system for establishing a reason for the closeness. By filling in this matrix, the programmer begins to think deeply about space characteristics and the relationships. He is guided also into thinking in terms of value judgments. Admittedly, the matrix becomes complex; but, on the other hand, it offers opinions which later can be organized and analyzed as a set of governing factors. This technique guides the programmer into making investigations of greater depth and securing opinions, but stops short of dictating solutions for the ultimate design. — *Ref. 34*

Technique No. 35

"INTER-COMMUNICATION AND PERSONNEL MOVEMENT CHART"

To state the inter-communication and personal movement patterns between spaces, one architect and his client prepare relationship charts to show the frequency or irregularity of inter-communication between spaces. Such a chart is shown in the form of a matrix on the left side of Exhibit 23.

Using the same technique, they also identify the frequency or

Exhibit 23
INTERCOMMUNICATION & MOVEMENT CHARTS

Intercommunication & Personnel Movement Patterns -1
With Other Departments and Buildings on Campus

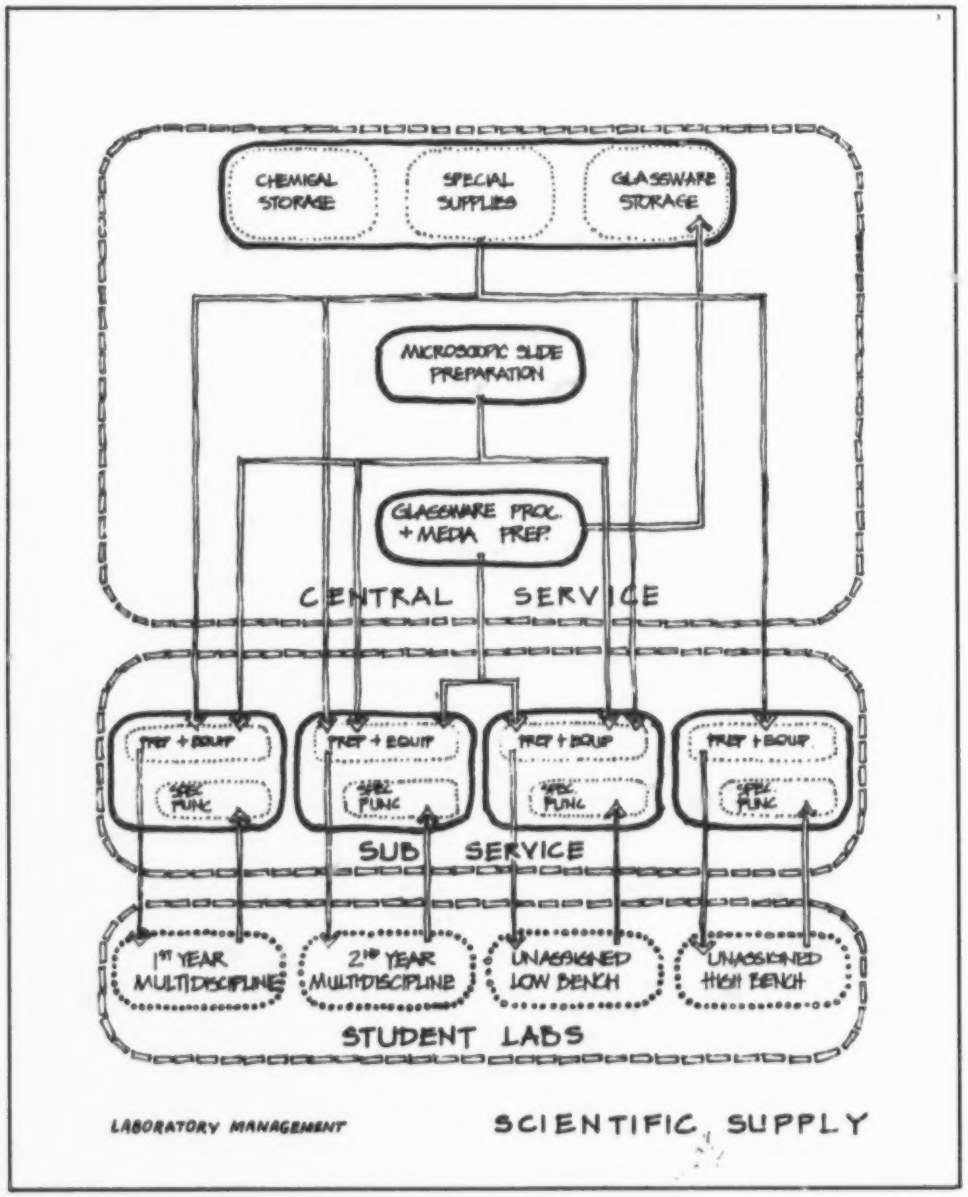
Department Areas	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Reception, Offices, Conferences	F	F	F	F	F	F	F	F	F	I	F	I	S	S
2. Student & Education		S	I	S	S	S	I	S	I	I	S	I	S	S
3. Chambers; Hot, Cold, Altitude			F	I	I	S	I	F	F	I	F	S	F	I
4. General Testing				I	F	S	I	F	F	I	F	S	S	S
5. Chemistry					F	I	I	I	F	F	I	S	I	S
6. Metabolic Unit						S	I	I	I	I	I	S	S	S
7. Animal Research							I	S	I	I	S	S	S	S
8. Shop								S	I	F	S	I	F	I
9. Medical Exam									I	S	F	I	S	S
10. Data Handling & Computation										I	S	F	S	S
11. Equipment & Chemical Storage											S	I	I	S
12. Subject Preparation & Dressing												I	S	S
13. Biomechanics Complex													S	S
14. Mechanical Equipment														I
15. Penthouse														

Legend
F Frequently
I Irregularly
S Seldom

Intercommunication and Personnel Movement Patterns -2
Within Laboratory for Human Performance Research

		Frequently	Irregularly	Seldom
I.	ec Building	F		
II.	Life Sciences	F		
III.	Human Development		I	
IV.	Computation Center	F		
V.	Anthropology		I	
VI.	Mineral Industry		I	
VII.	Electrical Engineering		I	
VIII.	Air Environment Center			S
IX.	Still Photography		I	
X.	Audio Visual		I	
XI.	West Halls		I	
XII.	Ordnance Research Lab			S
XIII.	Pattee Library	F		
IXV.	Keller Building			S
XV.	Nittany Lion Inn		I	
XVI.	Women's Phy. Ed.		I	
XVII.	Old Main		I	
XVIII.	Willard Building		I	
IXX.	Ritenour Health Center	F		

Exhibit 24
MANAGEMENT RELATIONSHIP ANALYSIS



irregularity of inter-communication with other departments on the same campus, but not in the same building. This application, shown in the list on the right side of Exhibit 23, is important when the programmer is required to select the most favorable site for a building on a campus to minimize walking back and forth. — *Ref. 35*

Technique No. 36

"MANAGEMENT RELATIONSHIP ANALYSIS"

The architectural programmer often finds similarities between organizational charts, functional charts, and space relationship charts. For this reason, the analysis of an organizational chart is an important programming technique. One such chart, shown in Exhibit 24, graphically analyzes the management of the scientific supply section of a university hospital. This functional chart shows communications, relationships, and functional groupings. — *Ref. 36*

Technique No. 37

"FUNCTIONAL RELATIONSHIP ANALYSIS"

One architectural firm makes a complete analysis of functions for a specific department and assembles the data into a master relationship chart as shown in Exhibit 25. This type of chart shows the complexity of the functional departmental relationships. The firm also prepares a second chart, as shown in the small diagram on the Exhibit, which diagrams the relationship between the specific department and other related departments of the building complex. — *Ref. 37*

Technique No. 38

"PLANT FUNCTION DIAGRAMS BY PHASES"

The need for programming multi-phase building construction makes it necessary for architectural programmers to develop the ultimate needs of the client. One architectural firm analyzes the ultimate building facilities requirements and then charts those facilities required during the initial phase and those which can be delayed until a second phase. Exhibit 26, made by the firm, is a space relationship diagram which shows clients and others the total

Exhibit 25
INTERDEPARTMENTAL RELATIONSHIP ANALYSIS

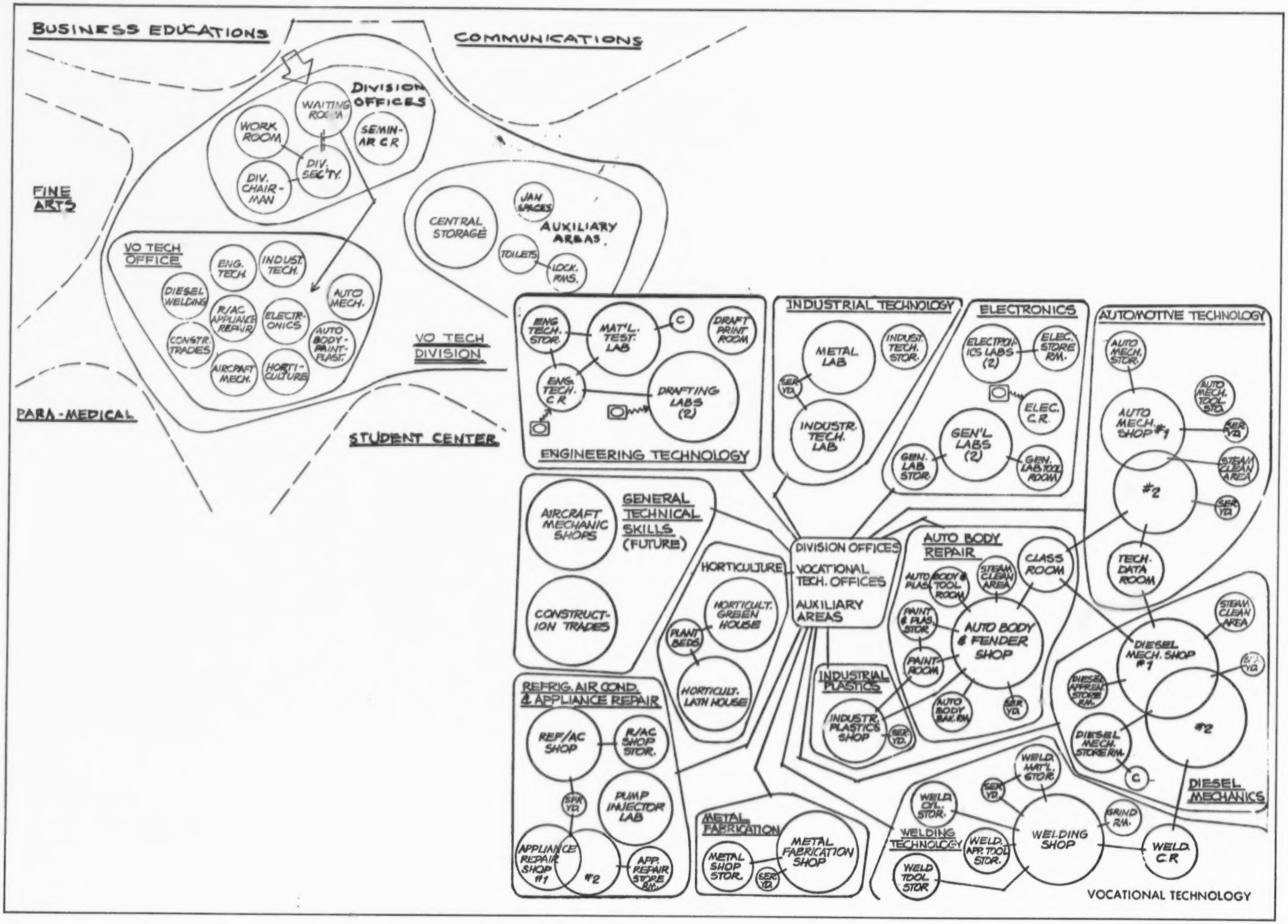
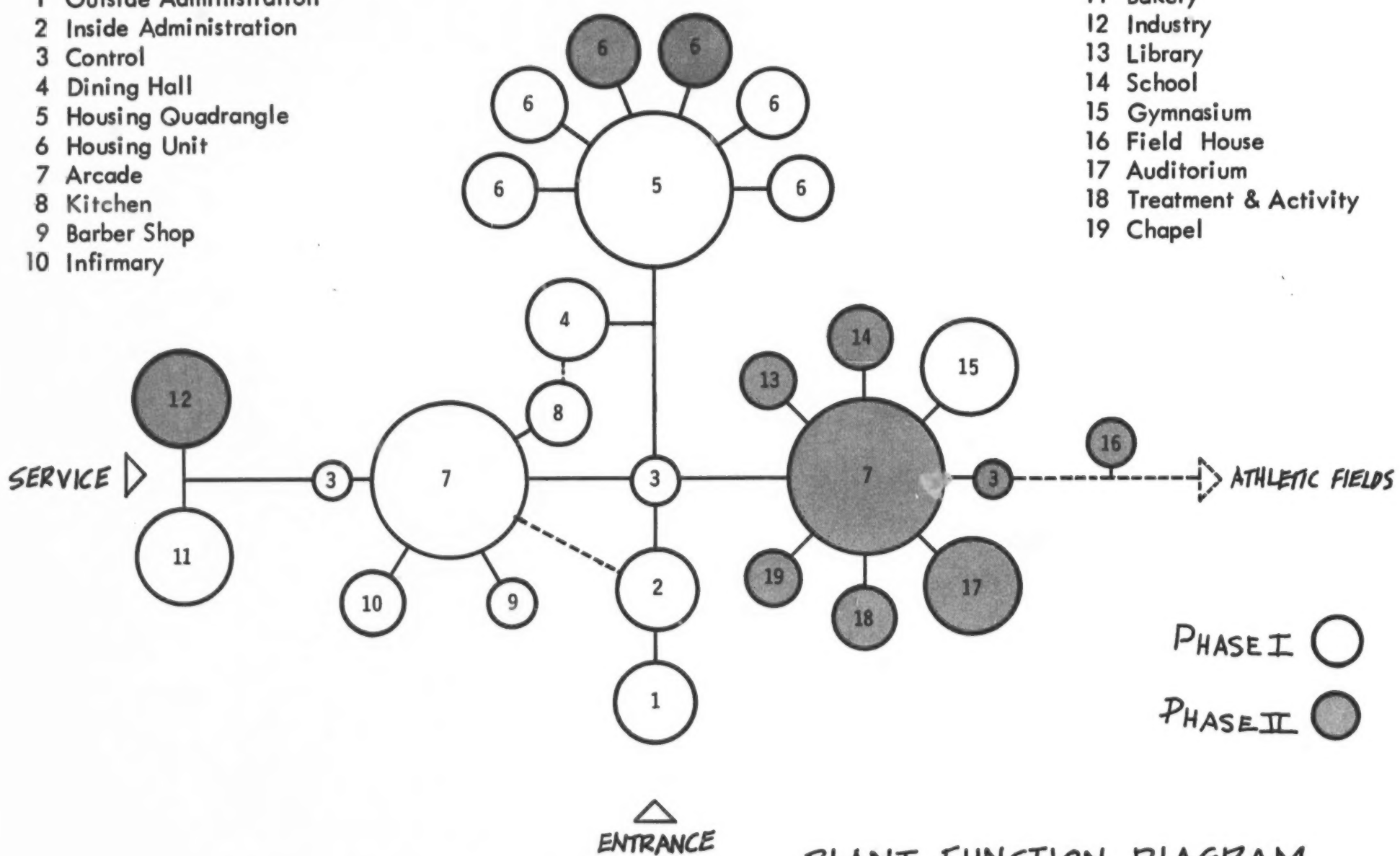


Exhibit 26
PLANT FUNCTION DIAGRAMS

1 Outside Administration
2 Inside Administration
3 Control
4 Dining Hall
5 Housing Quadrangle
6 Housing Unit
7 Arcade
8 Kitchen
9 Barber Shop
10 Infirmary

11 Bakery
12 Industry
13 Library
14 School
15 Gymnasium
16 Field House
17 Auditorium
18 Treatment & Activity
19 Chapel



PLANT FUNCTION DIAGRAM

Exhibit 27
SPACE RELATIONSHIP ANALYSIS

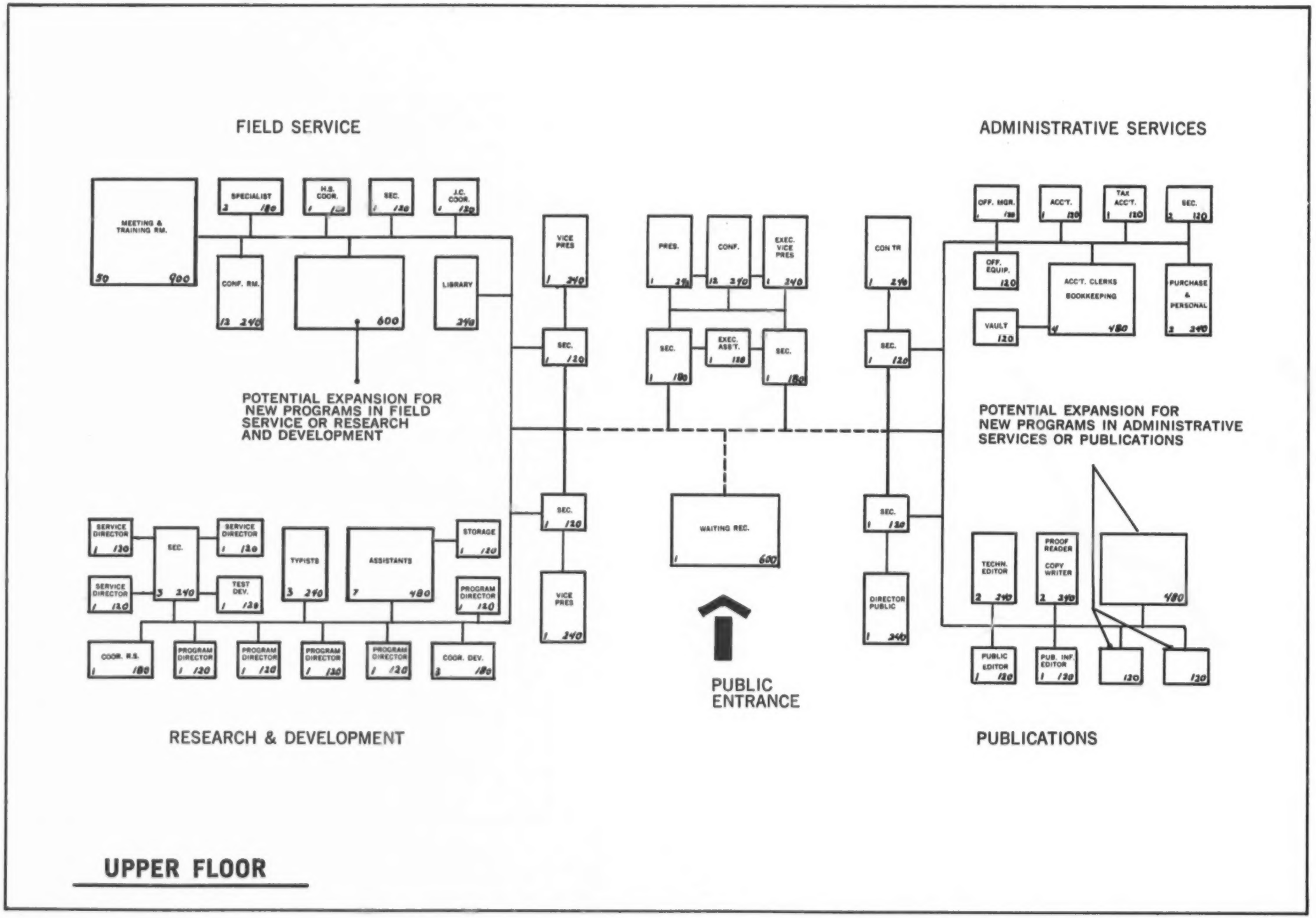
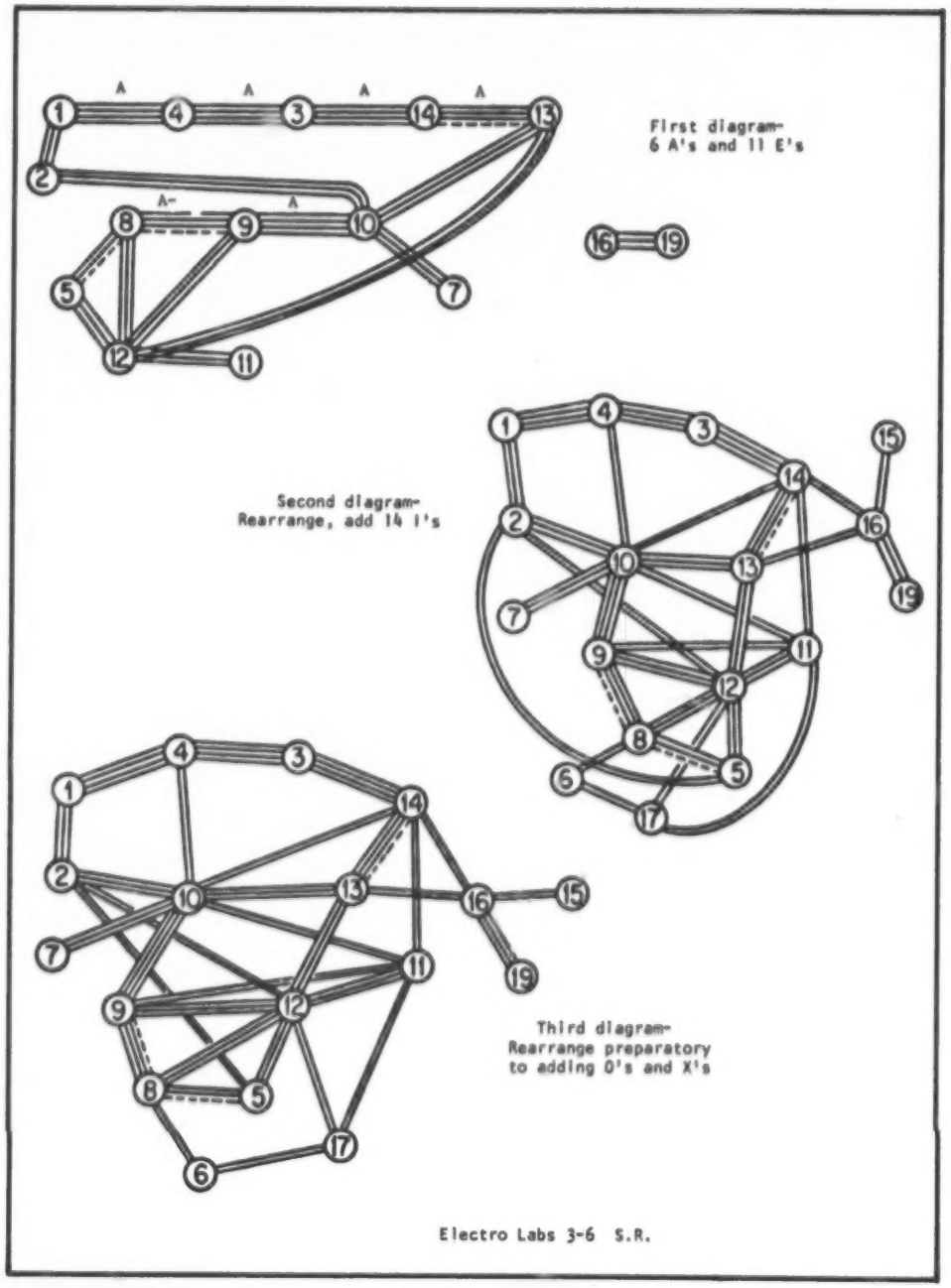
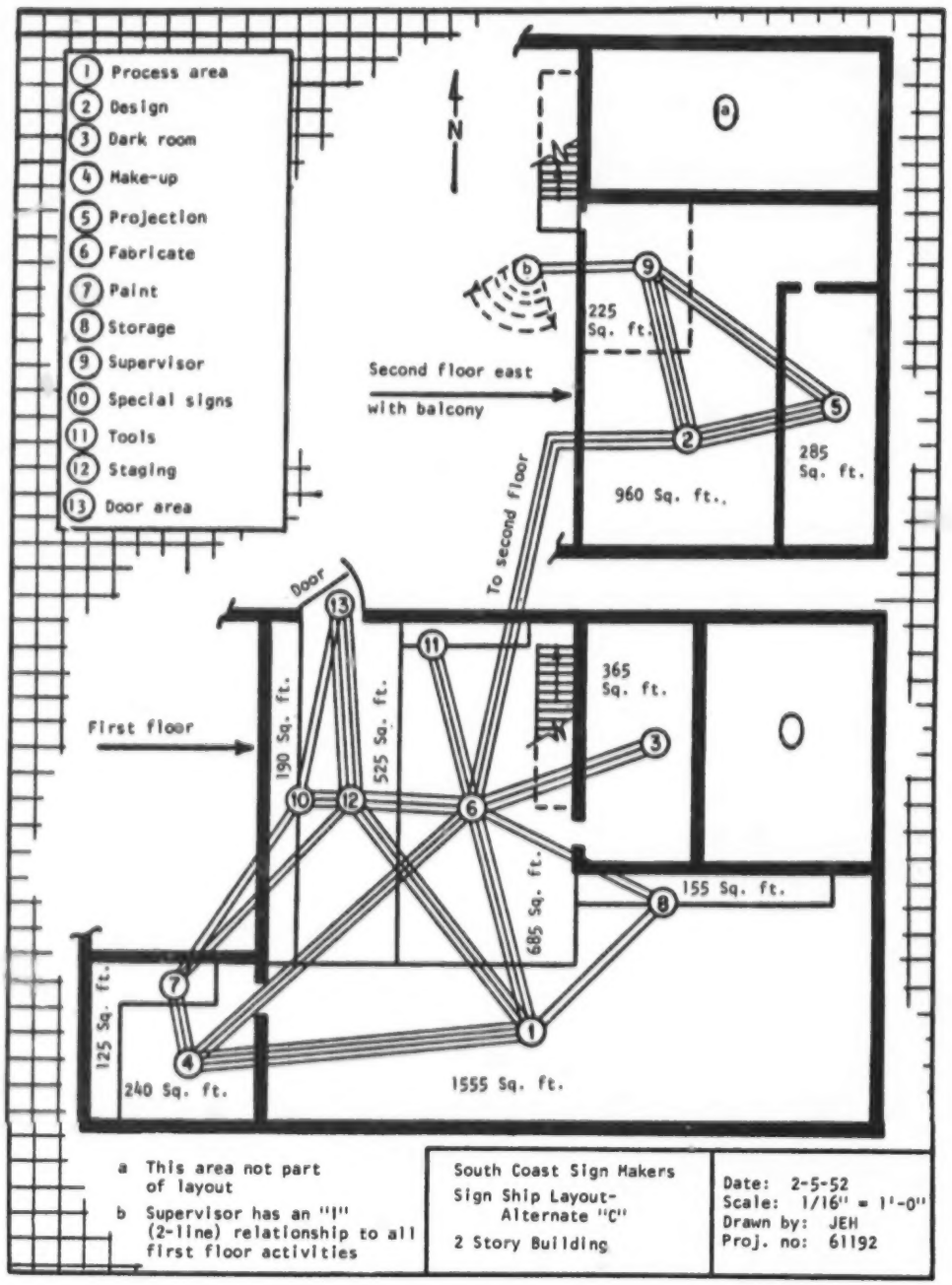


Exhibit 28
ACTIVITY RELATIONSHIP ANALYSIS





complex, and then shows the phase I buildings and the phase II buildings by a difference in shading. — *Ref. 38*

Technique No. 39

"SPACE RELATIONSHIP DIAGRAM"

Architectural programmers use either the circular or rectangular diagramming to show space relationships. One architectural firm prepares space relationship diagrams, as shown in Exhibit 27, which identify spaces by scale, by number, and by square footage. They also show present and future building programs in four categories, linkages, and access points. — *Ref. 39*

Technique No. 40

"ACTIVITY RELATIONSHIP ANALYSIS"

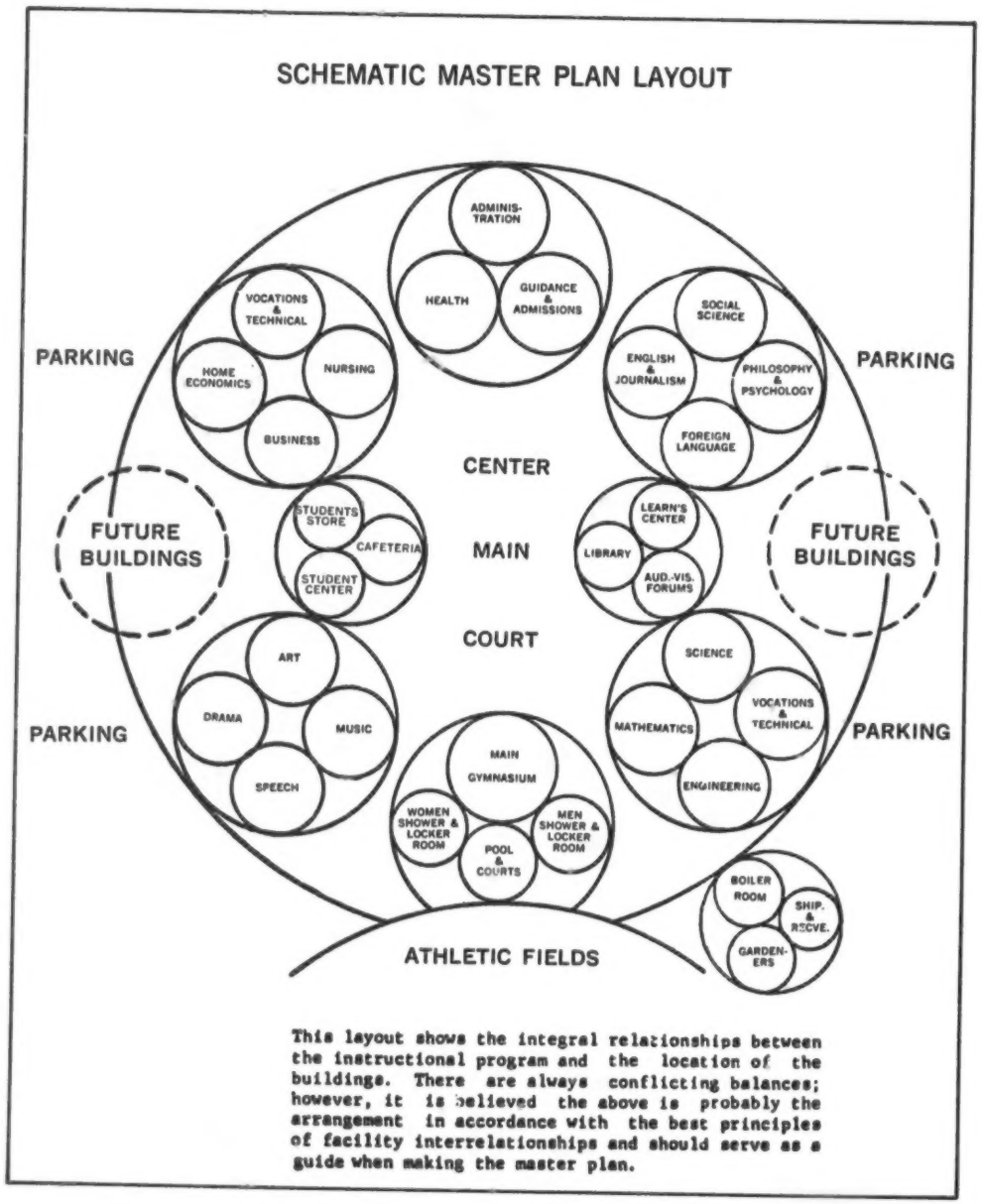
Architectural programmers use the techniques of activity analysis as shown in Exhibit 28. This is an example of a method of diagramming activities to show visually and graphically their relationships. The number in nodes represents an activity and the line code between nodes represents a closeness rating or special relationship. The technique can be developed theoretically to form the most advantageous arrangement. Then, the technique can be used later on in scheming by superimposing the diagram over a proposed space arrangement also in the shown Exhibit. Such an analysis assists in the placement of barriers, doors, and like items. — *Ref. 40*

Technique No. 41

"FUNCTIONAL PLANT LAYOUT ANALYSIS"

Industrial engineering studies in the field of plant layout have shown architectural programmers how they can organize and state problems in a format which can then be analyzed for layout. Whether the final comparison and analysis is done by hand or by computer, the conceptual information necessary to: (a) analyze space layouts and (b) minimize material movement and personnel circulation is accomplished by using the same formats for data gathering. One technique for showing material handling loads between work centers is in the form of matrix which shows: (a) the work centers by numbers on the horizontal and vertical and (b)

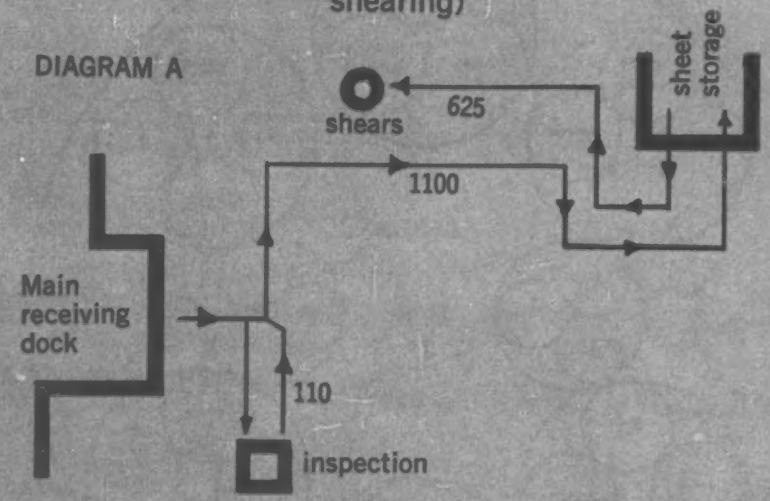
Exhibit 29
SCHEMATIC MASTER PLANNING



Step One: Building Up Data

(Example: Materials moving from receiving to shearing)

DIAGRAM A



LOOK FOR:

Time or space consuming back tracking or cross overs

Work returning to a department or machine it has already been to

Disadvantages of the existing starting and ending point arrangement. Consider straight flow, etc.

Efficiency of flow patterns where varied product are involved

SEQUENCE and physical relationships of steps involved in a shear operation can be shown in a simple diagram.

Step Two: Building Up Data

(Breaking down the elements and distances between)

A BREAKDOWN of Diagram A can be made to show the elements involved in the receiving to shearing sequence and the distances between each of the successive steps.

DIAGRAM B

SEQUENCE	operation	inspection	transportation	storage	Dist.
Receive at dock	○				16 ft.
Move to dock hold area			→		
Store				▽	
Carry to inspection			→		
Inspect		□			110 ft.
Move to storage hold area			→		80 ft.
Store				▽	
Move from storage to forward hold area			→		30 ft.
Store				▽	
Move to shear			→		625 ft.
Store in shear hold area				▽	
Move to machine staging area			→		20 ft.
Shear				▽	
Move from staging area to machine			→		5 ft.
Shear	●				
Move finished goods to forming staging area			→		46 ft.
Store				▽	
Remove scrap			→		10 ft.

the intersection of work centers showing a number representing loads. Understanding the problem becomes the focus of attention for the programmers involved at an early stage rather than solving the problem. The techniques of setting up the problem and analyzing it become a lead step to problem solution. — *Ref. 41*

Technique No. 42

"OPERATIONS RESEARCH ANALYSIS"

The complexity of hospital design and the advent of operations research have been combined by architectural firms and consultants as a method of attack for programming the needs for new hospitals. One such investigation by a hospital programmer resulted in the innovation of a supply train to provide efficient transportation by means of ramps in a five-story hospital. The reference referred to here is made, not to cite the innovation itself, but, to focus attention on the technique of using operations research methodology to investigate and analyze problems. — *Ref. 42*

Technique No. 43

"SCHEMATIC MASTER PLAN LAYOUT"

One consultant in the field of architectural programming analyzes "integral relationships between the instructional program and the location of buildings" shown in Exhibit 29. The graphic method of showing relationships by circles within circles has a certain functional simplicity which lends itself to campus master planning. — *Ref. 43*

Technique No. 44

"TRAVEL CHARTING & ANALYSIS"

Hospitals, industrial plants, office complexes, laboratories, and such types of buildings require that considerable attention be given to the analysis of travel time. In the commercial types of buildings, inefficient travel may cause a loss of profit and in hospitals it may cause the loss of life and health. Now the techniques for analyzing travel between spaces are becoming sophisticated.

To simplify, and even accelerate, the solving of space layouts by minimizing travel time, architectural programmers are using tech-

Exhibit 31
TRAFFIC DISTRIBUTION ANALYSIS

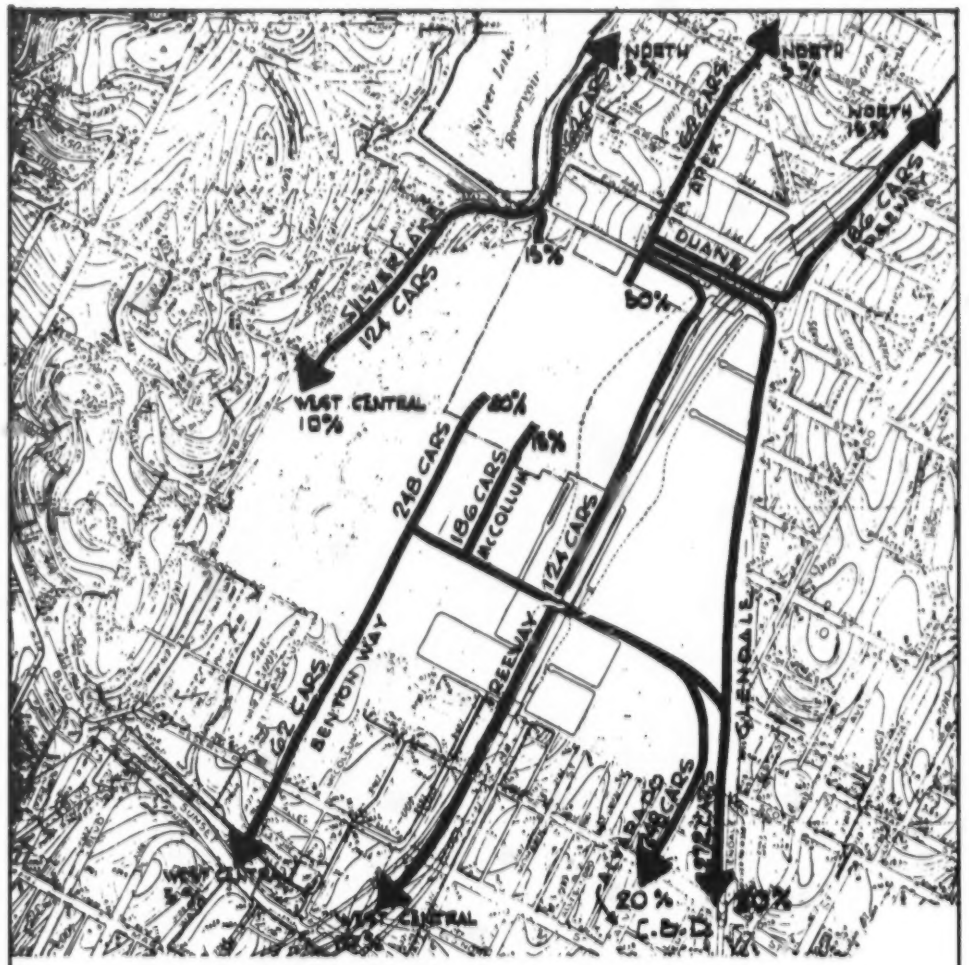
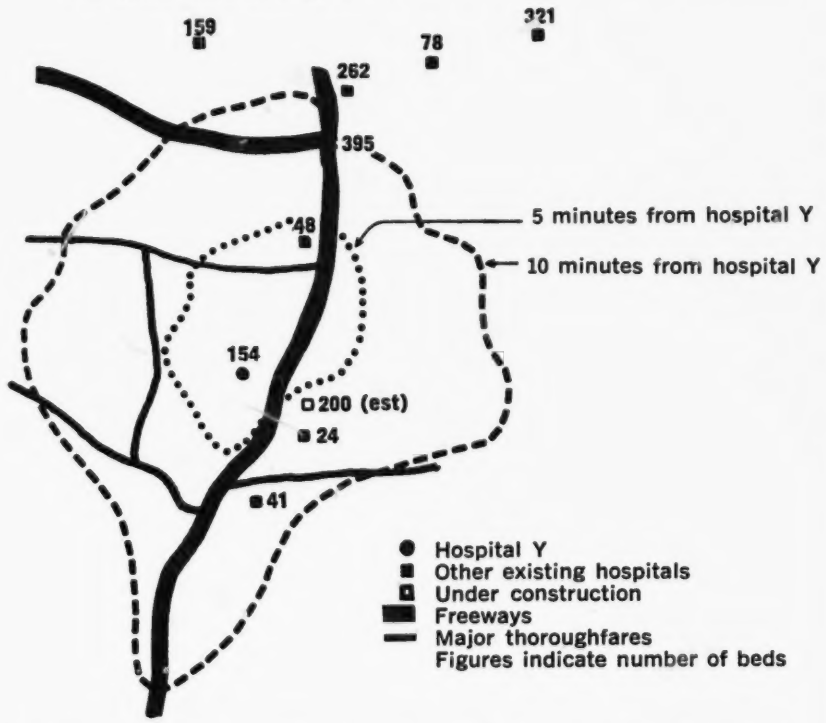


Exhibit 32
MINIMUM PATH ANALYSIS

Figure 2. Isochrons showing 5 and 10 minutes of travel time from hospital Y in Santa Clara County, Calif.



NOTE: Figures indicate acute short-term beds in hospitals. The isochrons are drawn by plotting the time values from the hospital for the mapped points shown in Fig. 1. By selecting those values ranging around 5 and 10 minutes, with interpolation a sufficient number of plots are obtained to allow their connection as shown.

PUBLIC HEALTH REPORTS

niques developed by industrial engineers. One such technique involves the listing of travel units showing a sequence of travel between spaces as: (a) the number of trips per day or month, (b) the load per trip for volume per month, and so on. The accumulation of data which later can be used in problem solving involves estimating the total travel or movement problem in a quantitative way.

The techniques used involve the preparation of: (a) distance charts, (b) move charts, (c) travel charts, (d) calculation of average aisle distance per move charts, (e) calculation of optimum travel chart, and so on. By charting and analyzing travel problems, a programmer serves the dual purpose of solving the problem in accordance with the method of stating the problem. The saving in the design process therefore eliminates the re-organization of material which then requires re-study and re-education of those involved in the approval process. — *Ref. 44*

Technique No. 45

"MOVEMENT ANALYSIS"

Architects, especially those concerned with industrial work, are analyzing the flow of people and materials through spaces. Exhibit 30 shows two diagrams representing two steps in building up data on the flow of materials from one space to another. The first diagram shows a layout of materials moving from one space to another. The second diagram shows graphically the movement of an item through spaces by identifying operations and activities in a sequence and also showing distances. — *Ref. 45*

Technique No. 46

"TRAFFIC DISTRIBUTION ANALYSIS"

Early in the appraisal and analysis of specific sites, architectural programmers and planners face the problem of traffic distribution on the surrounding streets. Such an analysis of peak hour volume traffic distribution, shown in Exhibit 31, was made by an architectural firm to show the traffic problem. — *Ref. 46*

Technique No. 47

"MINIMUM PATH ANALYSIS"

Distance or travel time has a vital effect upon the use of facilities. In this respect, travel time distance has been determined by trans-

portation engineers to be the pertinent factor rather than highway distance. One of the techniques used in investigating the highway network around hospitals and such building complexes which depend on occupants traveling to and from the complex is the establishment of fact finding programs to predict travel movement and minimum path trees. Such investigations usually result in the establishment of the transportation arteries around the hospitals and the preparation of Isochrons showing the five and ten minutes of travel time which ambulances or emergency vehicles take from any point in the community to the hospital. Exhibit 32 shows a layout of five-minute and ten-minute travel time Isochrons or contours. — *Ref. 47*

Technique No. 48

"TRAFFIC SURVEY AND ANALYSIS"

One of the typical techniques for showing traffic into and within building complexes or campuses is a technique used by traffic engineers. A "Cordon Line" is established around the building site or subject area so that the various trips or movements — through, into, and within — can be estimated and/or recorded. The small diagram on Exhibit 33 shows the principle of the traffic survey

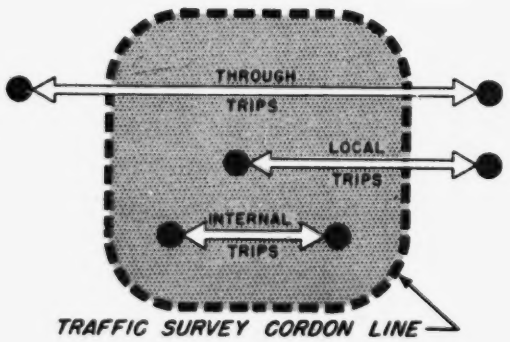
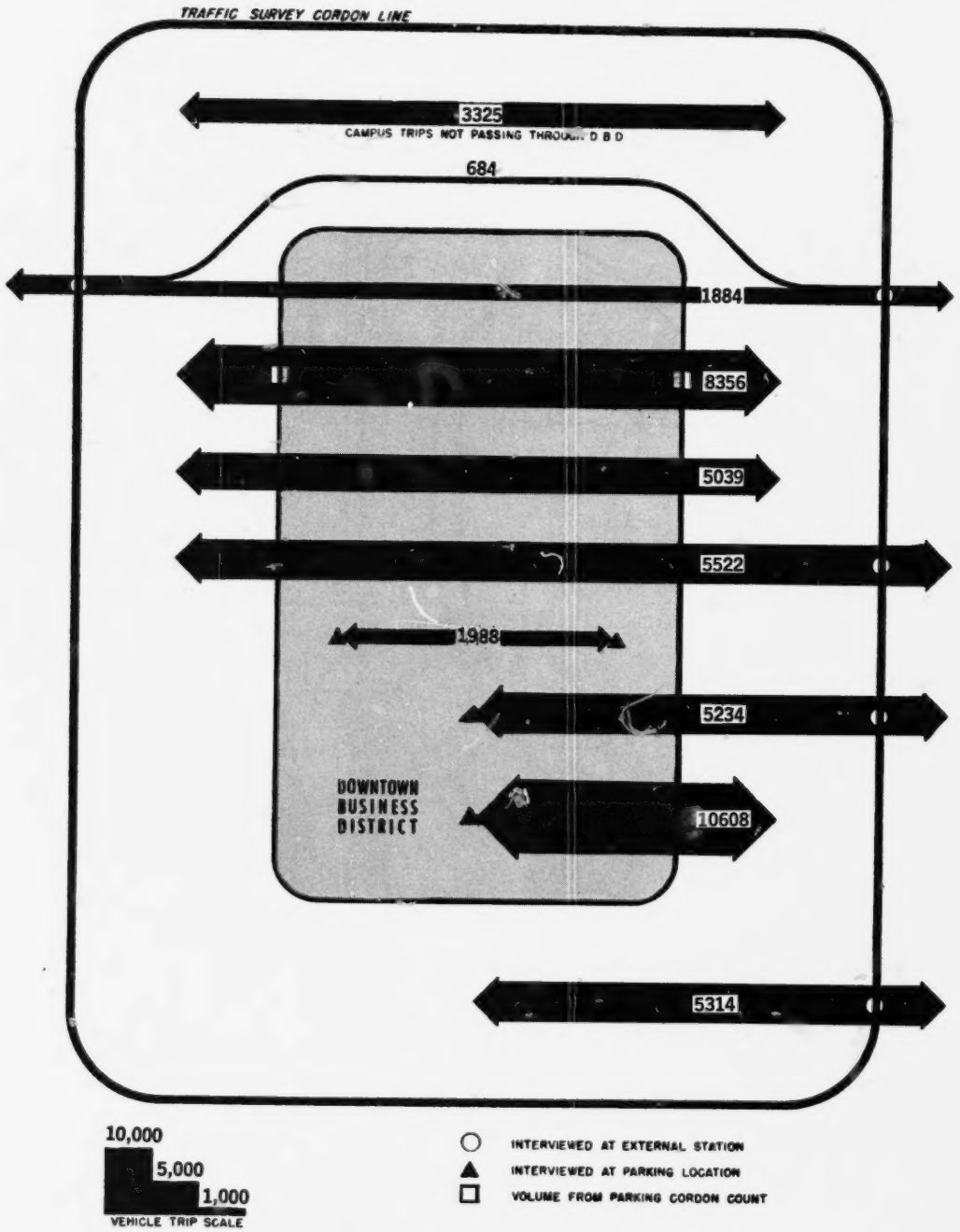


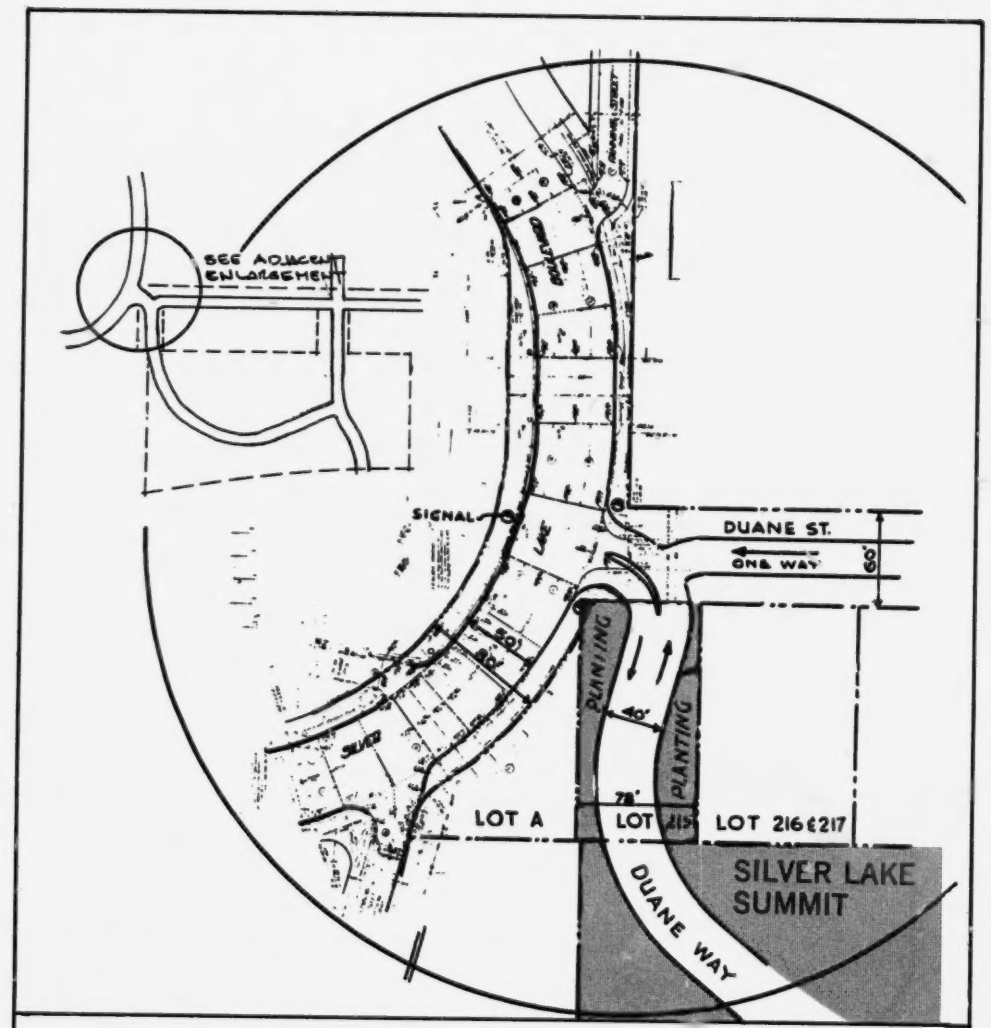
Exhibit 33
TRAFFIC SURVEY ANALYSIS



TYPE AND DISTRIBUTION OF TRIPS
STATE COLLEGE TRAFFIC SURVEY — 1954

PLATE 3

Exhibit 34
TRAFFIC INTERCONNECTION ANALYSIS



Cordon Line and the large diagram shows an application of the techniques using two cordon lines — the one around the building complex and the other around the business area of the community in which the building is situated. — *Ref. 48*

Technique No. 49

"TRAFFIC INTER-CONNECTION ANALYSIS"

Architectural programmers, planners, and site engineers realize the serious complications which new site traffic causes when it is added to the surrounding highway system. Architectural programmers are analyzing the traffic inter-connections of a specific proposed site to make sure that the new site inhabitants can move safely to and from the site. Such an analysis is shown in Exhibit 34, which accents the traffic hazards which may be caused by sharp turns, steep grades, backed up traffic, traffic lights, and so on. — *Ref. 49*

Technique No. 50

"DESIRE-LINE ANALYSIS"

Planners and engineers used a method of graphically showing the relative volume of trips between buildings, towns, or other spaces. The technique is called desire line analysis and a chart is shown in Exhibit 35. This is a simplified map showing, by various band widths, the number of "desired" trips between a building and geographic places in a state. Architectural programmers are applying this technique to the analysis of circulation within building complexes and campuses. — *Ref. 50*

Exhibit 35
DESIRE-LINE ANALYSIS

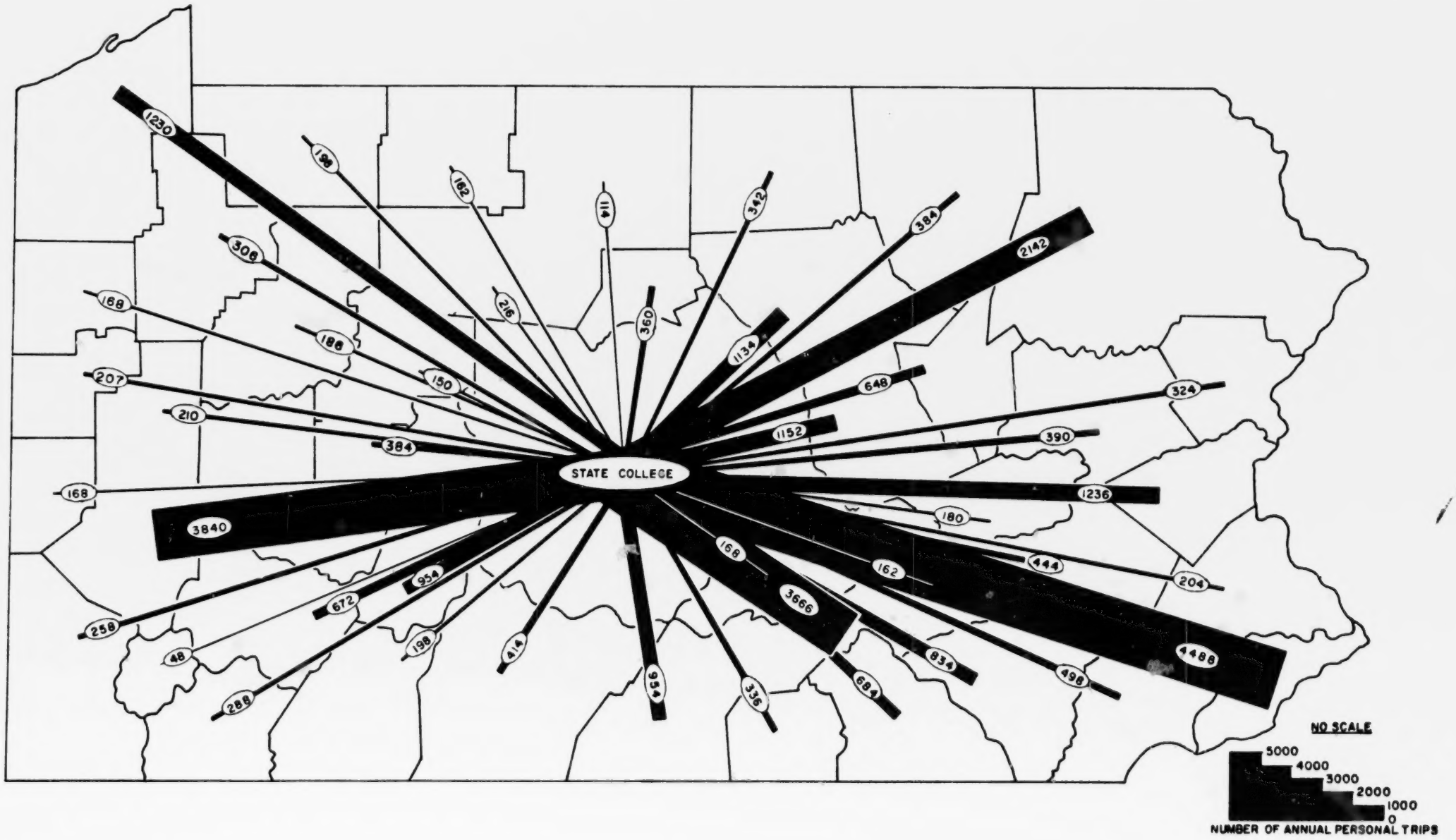
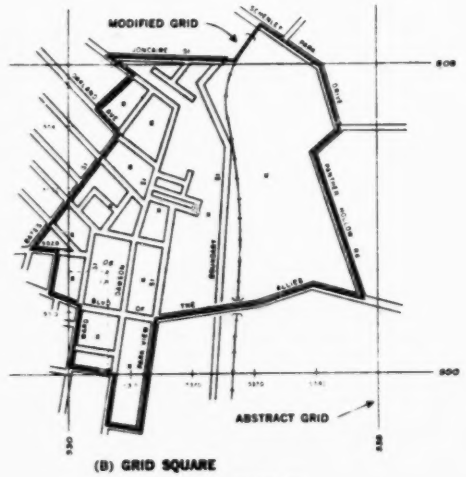
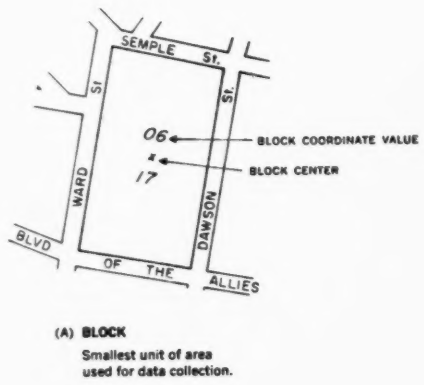


Figure 7 Desire-line Chart for State College-Bellefonte Trips Within Pennsylvania

Exhibit 36
GEOGRAPHIC IDENTIFICATION



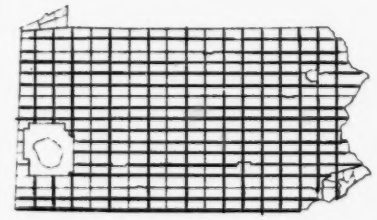
(B) GRID SQUARE
Smallest unit of area, outside the Golden Triangle, used for data summarization.



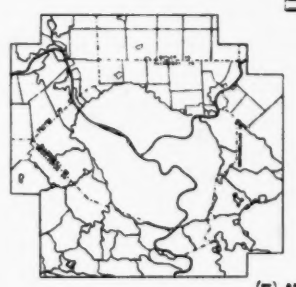
(A) BLOCK
Smallest unit of area used for data collection.

(I) UNITED STATES
Data coded to state or country.

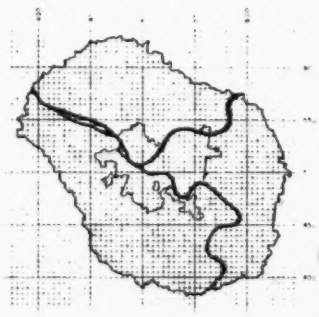
(H) SEVEN STATE AREA
Data coded to counties.



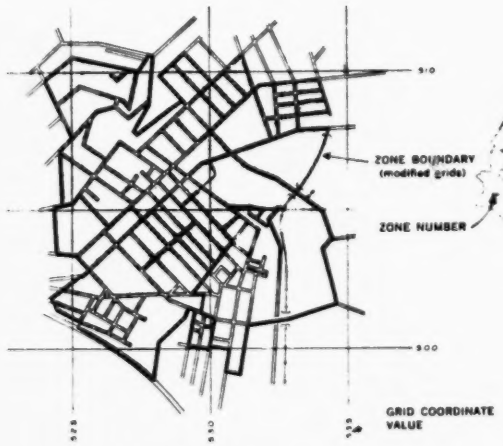
(G) STATE OF PENNSYLVANIA
Data coded to existing state-wide system.



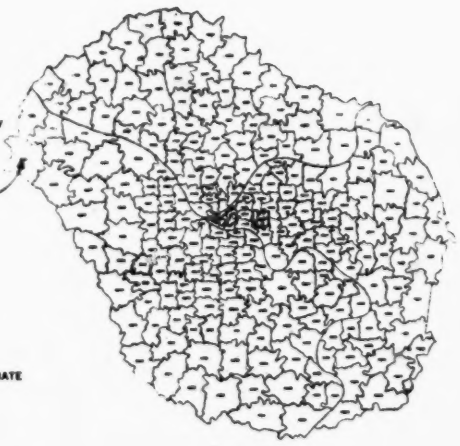
(F) ADJACENT AREA
Data coded to minor civil divisions.



(E) STUDY AREA
Data coded to block and grid.



(C) ANALYSIS ZONE
Smallest unit of area used for forecasting.



(D) STUDY AREA

GEOGRAPHIC IDENTIFICATION

TECHNIQUES OF PROGRAM PRESENTATION

Technique No. 51

"GEOGRAPHIC IDENTIFICATION AND CODING"

Architectural programmers are faced with presenting an accurate setting for the proposed building complex. Examples of a series of location maps identifying state, region, county, city, and down to even block number, are shown on Exhibit 36.

Even though clients and others know the location of their site, many of the problems of building placement, circulation, layout, zoning, and such have their origin in a good understanding of the exterior restaints which may be imposed upon the building. The architectural programmer uses the map technique not only to clearly identify geographic placement, but also to provide visual data which can be used to explain the many relationships which a building site has to its adjacent community, its nearby communities, its regional transportation, its utility systems, and even its place in the state and in the country. — *Ref. 51*

Technique No. 52

"ORIENTATION GRAPHICS"

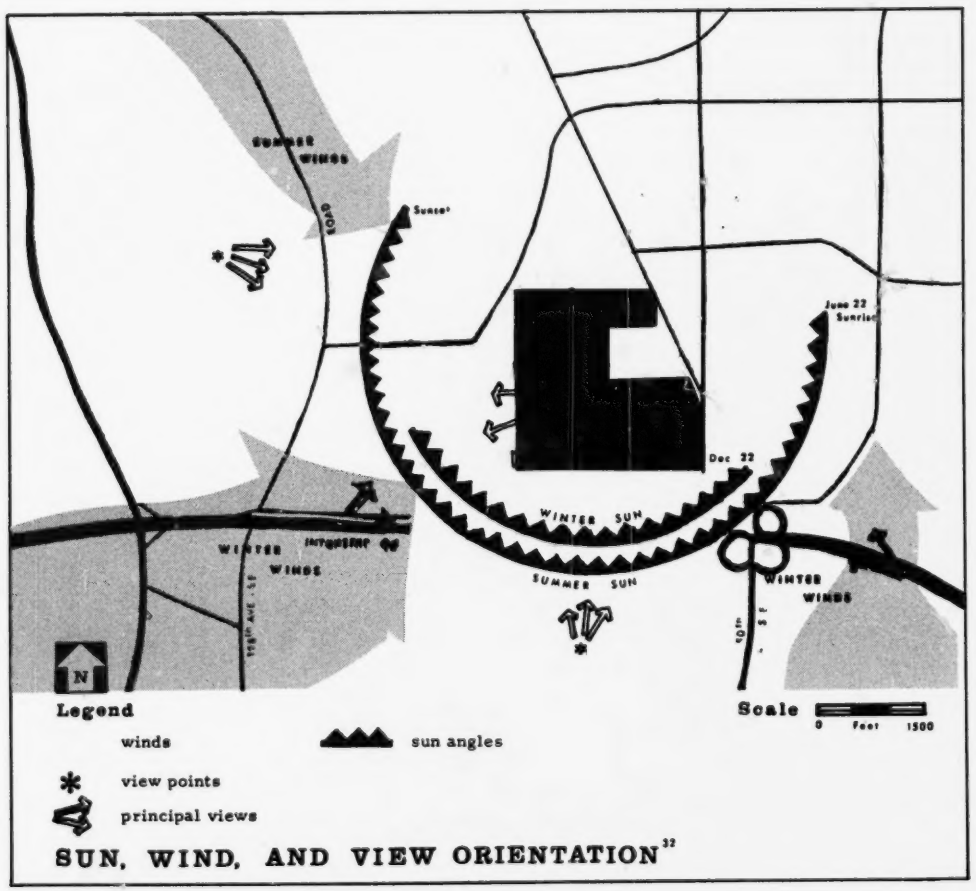
A favorite technique used by many architectural programmers and designers consists of graphic diagramming on site maps to show prevailing winds, solar orientation, circulation, views, and so on. Such a graphic representation is shown in Exhibit 37, and serves to explain to clients and others the importance of building orientation and site layout to take advantage of natural topography, to break up snow drifting, to lessen the heat loss caused by prevailing winds, to lessen solar heat gain from direct summer exposure, and so on. — *Ref. 52*

Technique No. 53

"PROJECTED OCCUPANCY & BUILDING CAPACITIES"

Architectural programmers project estimates of occupancy and at the same time suggest new buildings or additions by phases as

Exhibit 37
ORIENTATION GRAPHICS

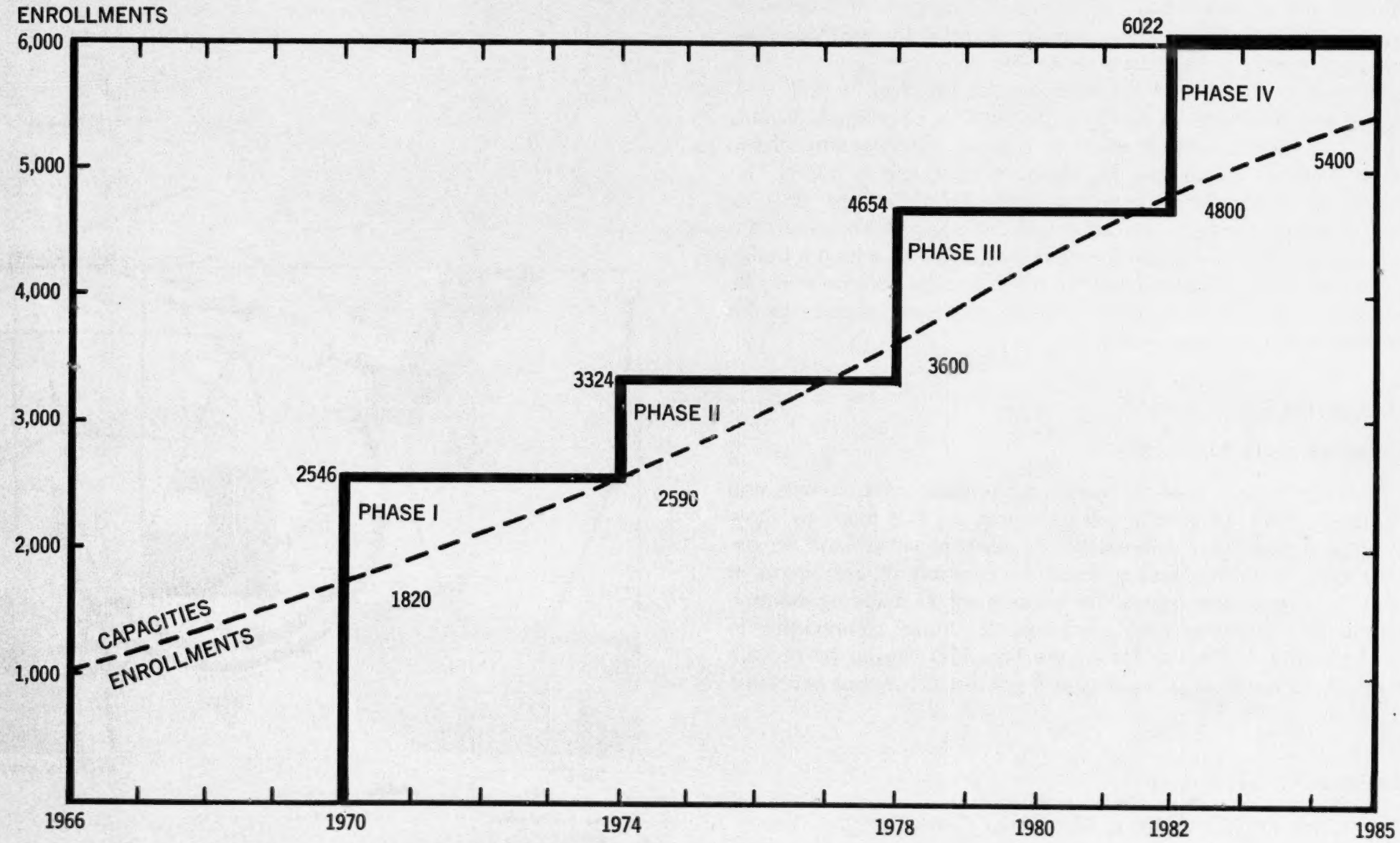


SUN, WIND, AND VIEW ORIENTATION[32]

Exhibit 38
PROJECTED CAPACITIES BY PHASES

Table G

PROJECTED ENROLLMENTS AND COLLEGE CAPACITIES



shown on Exhibit 38. Keeping building capacities above building occupancy figures is important in long-range planning, and the most impressive method of keeping clients informed of their building needs is to show a long-range projection of occupancy superimposed on a building program which provides for increases in capacity consistent with the increase in occupancy. — *Ref. 53*

Technique No. 54

"GRAPHIC REPRESENTATION OF TRAFFIC VOLUMES"

The volume of traffic in corridors, aisles, pathways, roads, avenues, and other arteries is often shown isometrically or three-dimensionally by a bar of varying heights. Exhibit 39 shows such a traffic volume model in which the volume is shown by height of the bar and identified by volume number also. It is typical of the many graphic techniques for showing volumes of circulation. The same technique in the form of block or stick isometrics identifies the volume or density of a space or block or area. — *Ref. 54*

Technique No. 55

"PROJECT TIME SCHEDULING"

One of the important considerations of architectural programming is timing and scheduling. A typical example of a bar-chart time schedule is shown in Exhibit 40. An architectural program usually requires a time schedule or network plan. This technique is especially important where time is critical and an expeditious building project means additional revenue for the client. — *Ref. 55*

Exhibit 39
TRAFFIC VOLUME GRAPHICS

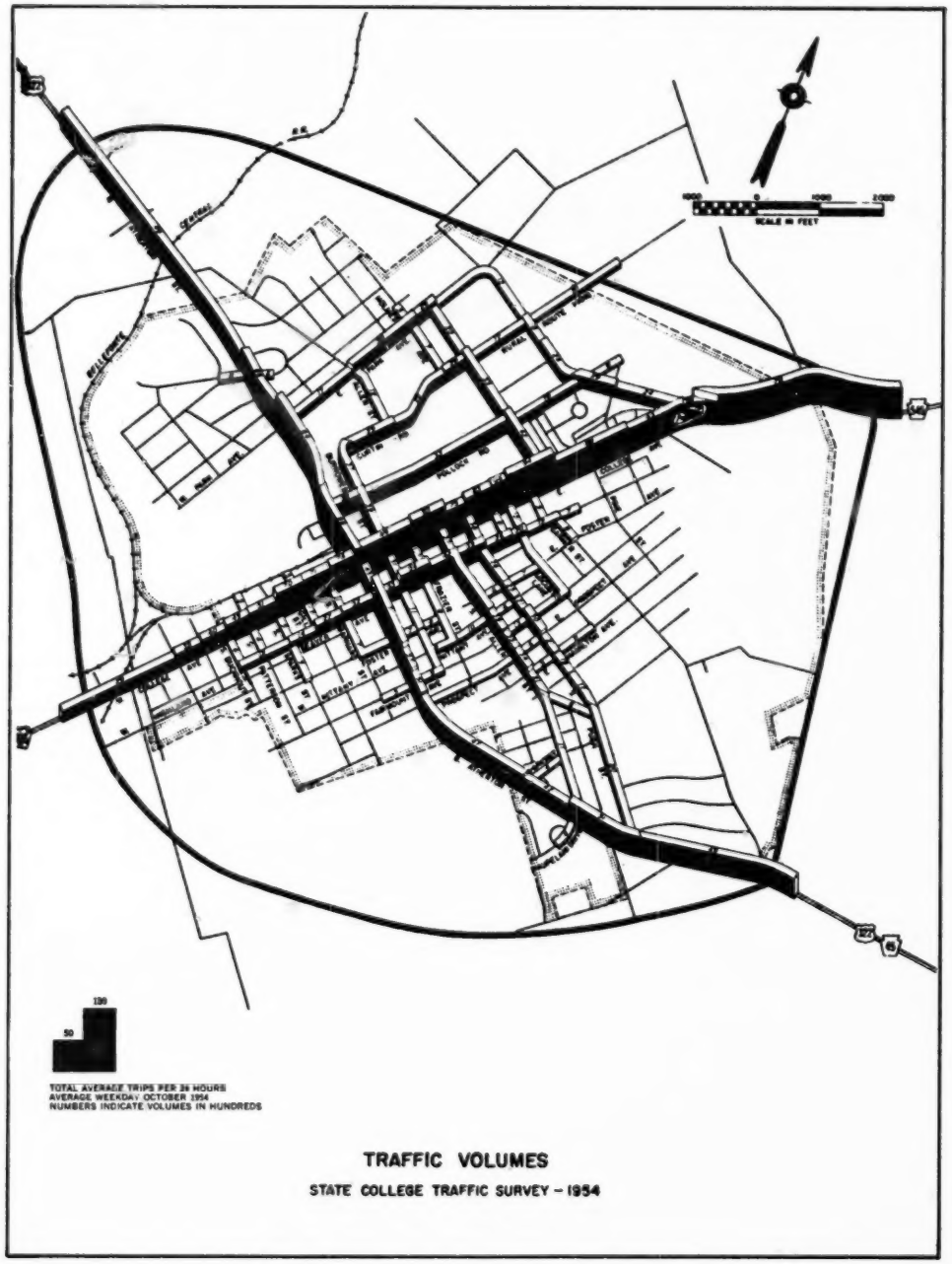
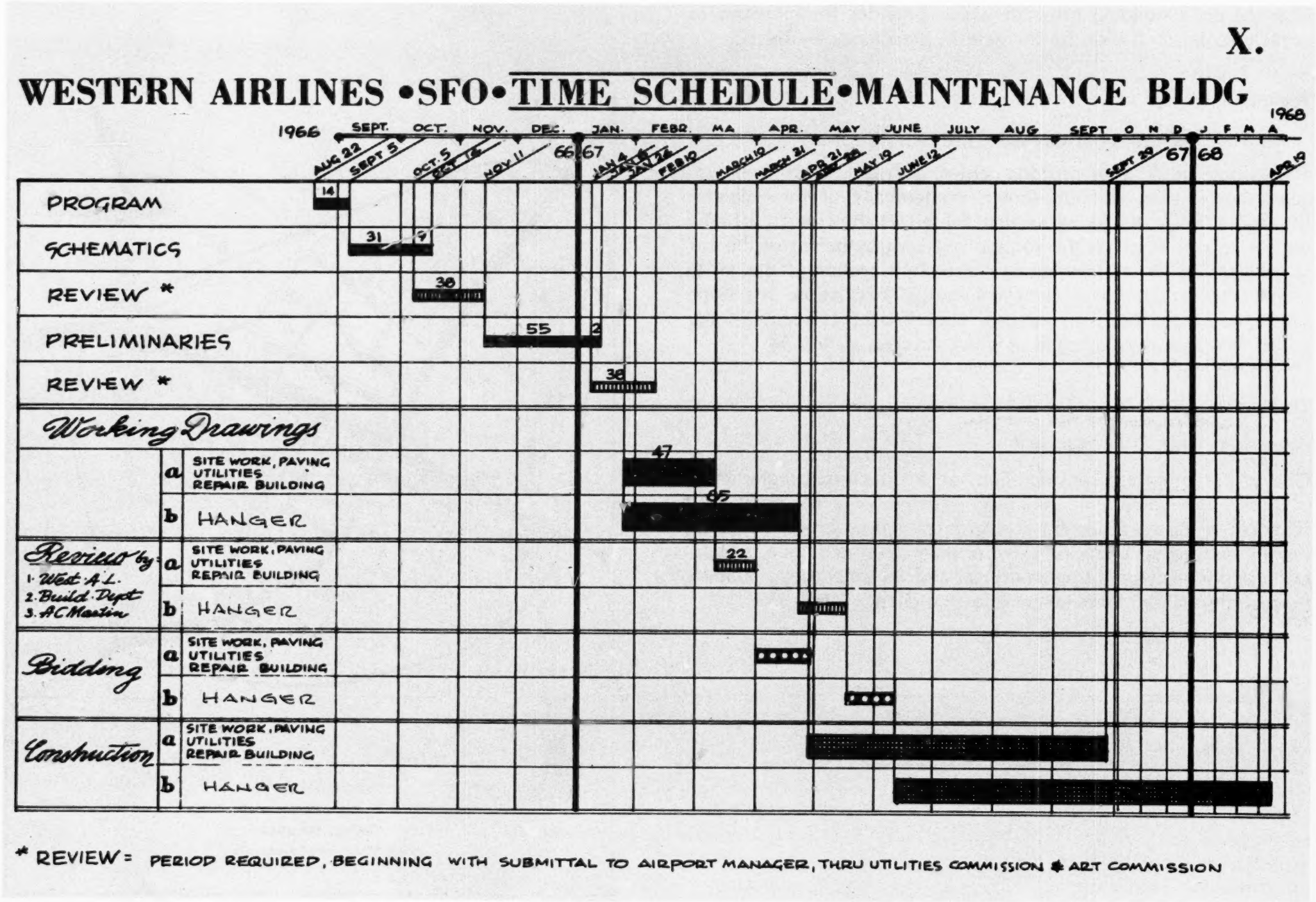


Exhibit 40
PROJECT TIME SCHEDULING



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3. *"Sequence of Decision Program Steps"* by Lester Gorsline Associates of Tiburon, Calif.
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16. *"A Land Use Plan Design Model"* by Kenneth J. Schlager in the AIP Journal, May, 1965.
17. Study Organization Chart from Area Transportation Study Findings, City of Pittsburgh, Pa.
18. *"Specific Room Data Form"* by Christie, Niles and Andrews of Towson, Md.
19. *"Room Requirements Format"* prepared by C. F. Murphy of Chicago, Ill.
20. *"Equipment & Services Chart"* by C. Herbert Wheeler, Jr., State College, Pa.
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